NASA CONTRACTOR
REPORT

NASA CR-61386

SKYLAB EXPERIMENT PERFORMANCE EVALUATION MANUAL

Appendix T: Experiment T027/S073 Contamination Measurement, Photometer and Gegenschein/Zodiacal Light (MSFC)

By J. E. Meyers
Teledyne Brown Engineering Company
Huntsville, Alabama

July 1973

Prepared for

NASA-GEORGE C. MARSHALL SPACE FLIGHT CENTER
Marshall Space Flight Center, Alabama 35812

TECHNICAL REPORT STANDARD TITLE PAGE

1. REPORT NO.	2. GOVERNMENT ACCESSION NO.	3. RECIPIENT'S CATALOG NO.
NASA CR-61386		

4. TITLE AND SUBTITLE	5. REPORT DATE
Skylab Experiment Performance Evaluation Manual. Appendix T: Experiment T027/S073 Contamination Measurement, Photometer and Gegenschein/Zodiacal Light (MSFC)	July 1973
	6. PERFORMING ORGANIZATION CODE
7. AUTHOR(S) J. E. Meyers	8. PERFORMING ORGANIZATION REPORT #
9. PERFORMING ORGANIZATION NAME AND ADDRESS Teledyne Brown Engineering Company Huntsville, Alabama	10. WORK UNIT NO.
	11. CONTRACT OR GRANT NO. NAS8-21804
	13. TYPE OF REPORT & PERIOD COVERED Contractor Report
12. SPONSORING AGENCY NAME AND ADDRESS National Aeronautics and Space Administration Washington, D. C. 20546	14. SPONSORING AGENCY CODE

15. SUPPLEMENTARY NOTES

Prepared for Astronautics Laboratory, Science and Engineering

16. ABSTRACT

This appendix contains a series of analyses for Experiment T027/S073, Contamination Measurement, Photometer and Gegenschein/Zodiacal Light (MSFC), to be used for evaluating the performance of the Skylab corollary experiments under preflight, inflight, and post-flight conditions. Experiment contingency plan workaround procedure and malfunction analyses are presented in order to assist in making the experiment operationally successful.

17. KEY WORDS	18. DISTRIBUTION STATEMENT
Skylab Experiments	Unclassified - Unlimited

William A. Kent

19. SECURITY CLASSIF. (of this report)	20. SECURITY CLASSIF. (of this page)	21. NO. OF PAGES	22. PRICE
Unclassified	Unclassified	275	NTIS

MSFC - Form 3292 (May 1969)

APPENDIX T. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT (MSFC)

Prepared By:

J. E. Meyers

TABLE OF CONTENTS

TABLE OF CONTENTS (Concluded)

LIST OF ILLUSTRATIONS

LIST OF TABLES

DEFINITION OF SYMBOLS

A · B	Both Filter Wheels, A and B are in Zero Position
AM	Airlock Module
ATM	Apollo Telescope Mount
AZ	Azimuth
CALIB	Calibration
CCU	Crewman Communications Umbilical
C. L.	Cap is open status
$\overline{\text{C. L.}}$	Cap is not open status
CM	Command Module
CMG	Control Moment Gyro
CONT	Continue
CRT	Cathode Ray Tube
CSM	Command Service Module
D	Filter Wheel Select Switches Set for A and B
DAC	Data Acquisition Camera
DOY	Day of year
E	Filter Wheel Select Switches Set for B Only
ELEV	Elevation (Trunnion)
FBD	Functional Block Diagram
FFF	Filter Flip-Flop
FFM	Filter Flip-Flop Memory
FO	Functional Objective
FOV	Field of View
FW	Filter Wheel
HI	High
HOSC	Huntsville Operations Support Center
k	Azimuth cw limit is met
L	Azimuth ccw limit is met
LIEF	Launch Information Exchange Facility
LIM	Limit
M	Elevation cw limit is met

MDA	Multiple Docking Adapter
MD/CSU	Motor Drive/Cassette Support Unit
MSC	Manned Spacecraft Center
MSFC	Marshall Space Flight Center
N	Elevation ccw limit is met
OA	Orbital Assembly
OPP	Opposite
OWS	Orbital Workshop
P	Polaroid
PABX	Private Automatic Board Exchange
PBRS	Push botton rotary switch
PC	Printed circuit
PCTVS	Portable Color Television System
P_f	Probability of failure
P_{f_n}	Net probability of failure
P_{f_t}	Total probability of failure
PI	Principal Investigator
PMT	Photomultiplier Tube
P. O. C.	Power on Clear
P_s	Probability of success
R	Selected number of sequences
S	A filter is next to be changed
$\overline{S}$	B filter is next to be changed
SAA	South Atlantic Anomaly
SAL	Scientific Airlock
SEC	Seconds
SEL	Select
S/I	Speaker/Intercom
$\underline{S. O.}$	Shutter is open status
$\overline{S. O.}$	Shutter is not open status
SW	Switch
TEC	Thermal Electric Cooler
UXM	Universal Extension Mechanism
10 SEC	10 second pulse (delay)
12 SEC	12 second pulse (delay)

SECTION I.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 1 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.0 Analyze and predict facet performance profile for Skylab Experiment T-027/S-073, Contamination Measurement, Photometer and Gegenschein/ Zodiacal Light.				N/A	Refer to functional item 3.1.
3.1 Make explicit statements about objectives in qualitative and quantitative terms.				N/A	The purpose of this experiment is to: • Measure the sky brightness background caused by solar illumination of the particulate contaminants found about the Orbital Assembly (OA) • Measure the surface brightness and polarization of the skyglow over as large a portion of the celestial sphere as possible at several wavelengths in the visible spectrum • Measure the surface brightness and polarization of the skyglow at the earth's terminator (with sunlight on the spacecraft) to determine the extent and nature of spacecraft corona. Zodiacal light is the glow that is produced by the scattered sunlight from the interplanetary cloud of small particles that circles the sun and extends as a band along the ecliptic. Because of the scattering characteristics of these particles, the brightness of the light is greatest toward the sun and decreases rapidly as it is viewed with large angles of elongation from the sun. In the vicinity of the sun, the interplanetary cloud of particles merges with the tenuous gases surrounding the sun to form the F-corona. In the anti-solar direction, there is an enhancement in the light again, and this glow is called the gegenschein. The F-corona, the zodiacal light, and the gegenschein are various names given to the same phenomenon--that of light scattering from small particles in interplanetary space. The photometer system uses a photoelectric photometer to measure all the light in its Field of View (FOV). Scattered light from contaminant material around the OA must be separated from the total measurement to analyze celestial skyglow (primarily zodiacal light, gegenschein, and starlight). Similarly, quantitative study of contamination is not possible without knowing the characteristics of the skyglow.

*Criticality Category Number Definition:

- Category I--Experiment and equipment whose failure could adversely affect crew safety.
- Category II--Experiment and equipment whose failure could result in not achieving a primary mission objective, but does not adversely affect crew safety.
- Category IIIa--Experiment and equipment whose failure could result in not achieving a secondary mission objective, but which does not adversely affect crew safety or preclude the achievement of any primary mission objective.
- Category IIIb--Experiment and equipment whose failure could not result in a loss of primary or secondary mission objective and does not adversely affect crew safety.

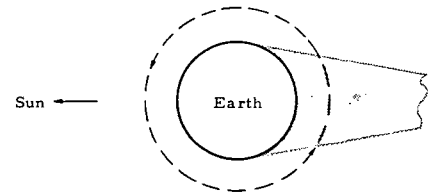
MSFC - One Time Form 17 (March 1972)

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 2 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					The photometer system measures three parameters that fully characterize the radiation from the skyglow and from the OA corona; i.e., brightness of the total and of the polarized components, and orientation of the plane of polarization. Measurements pertaining to the skyglow (including earth's F-region airglow and continuum components) are best performed on the dark side of the earth. Measurements on the earth's sunlit side and at the terminator will be used to characterize the contaminant cloud, and to provide information on skyglow (zodiacal light). The principle method of collecting photometric data that satisfy the experiment objectives is to scan the areas under study (e.g., ecliptic plane and pole, solar and anti-solar direction, and other regions of the celestial sphere). Scanning will be accomplished by using complex two-dimensional scans controlled by an automatic programmer. The programmer has 7 (0 through 6) operating conditions or modes: Mode — Objective 0 — Calibration 1 — Fixed Position 2 — Vertical Circle 3 — Almucanter 4 — Limited Sky Mapping 5 — All Sky Mapping 6 — Stowage Position Return The modes define the actual electro-mechanical operation of the photometer system. Specific measurement scanning programs (a through e) are operated within modes 1 through 5. These programs are defined by a specific target (gegenschein, ecliptic poles, etc.). Each program has associated with it specific operating conditions such as shaft (azimuth) trunnion (elevation) angles, orbital position of program start, duration of performance, and Scientific Airlock (SAL) location. In all, there are 18 separate programs. A description of each mode and program is given below: • Mode 0 CALIBRATION The calibration mode may be performed with the photometer in any orientation. The photometer is capped and looks at a standard calibration source instead of the sky. Each of the 10 filters is used to observe this calibration source for a preselected (1 to 64) number of times. It is necessary to perform Mode 0 one time (10 filters, 2 min 5 sec) prior to the start of every Mode 1 program. One calibration sequence is automatically performed at the conclusion of each sequence of Modes 2 through 5. --Program 0a, System Monitor This program is performed at any shaft (azimuth) and trunnion (elevation) setting. The photometer is capped, and the sequence counter is used to cycle through the 10 filters continuously throughout an entire orbit. This program provides information on system precision and on typical effects of the changing thermal environment. The program requires one orbit (94 min) to complete and may be started anywhere in the orbit. No Data Acquisition Camera (DAC) film is required for the above program.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 3 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					



Note: Start Program 0a anywhere in orbit.

- Mode 1 FIXED POSITION

This mode is performed with the photometer in a fixed position. Sky observations are made for a preselected number of times with all filters in Wheel A and Wheel B.

--Program 1a, Contamination

A change in brightness and, especially in polarization as the spacecraft leaves the earth's shadow, is a direct measure of the effect of the level of contamination (i.e., of the optical environment of the spacecraft). This program is capable of providing near real time information on orbital contamination.

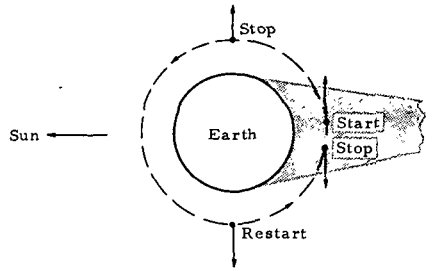
At any time this program is used, it can provide information on the zodiacal light at $\pm 90°$ elongation (angular distance from the sun). Comparison of observations in the ecliptic and at the ecliptic poles gives a measure of the flattening of zodiacal dust toward the ecliptic.

This program is performed with the photometer pointed in a direction 90° from the direction to the sun. This direction is maintained from program initiation in the earth's shadow to a position in sunlight. At that time, other programs (contamination) can be performed until the photometer is again in an orbital position 180° from where it was stopped. It is again pointed 90° to the sun line by a crewman. The crewman also restarts the program. The program operates until it is in the earth's shadow where it is terminated.

MSFC - One Time Form 17 (March 1972)

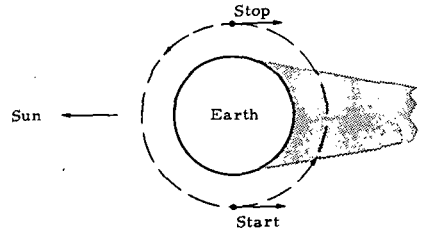
TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 4 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					Each of the observation periods requires 20 min. The total time required to complete the program is 40 min. The DAC will expose 192 frames of film for each program performance.



--Program 1b, Gegenschein
This program is intended as a monitor of short-term (min) changes in brightness and of possible changes associated with the observing aspect with respect to the earth's shadow.

The program is performed with the photometer pointed in the anti-solar direction. The orbital positions for starting and stopping the program are shown below. The observation time is 48 min. The DAC will expose 230 frames of film for each program performance.



MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 5 of 81)

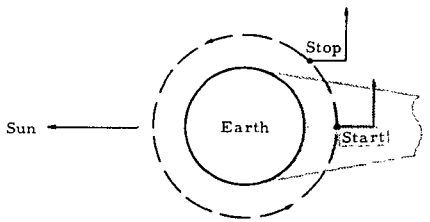
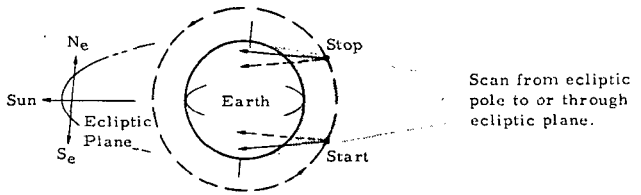
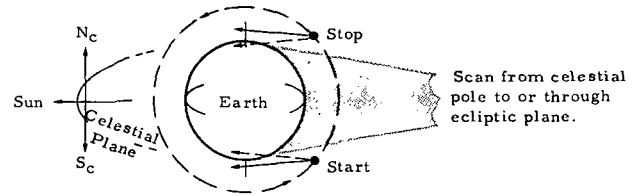
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					--Program 1c, Contamination A preselected region of the sky, which includes part of the OA, is observed before, during, and after an overboard venting. The program starts prior to leaving the earth's shadow and continues for some time on the sunlit side. The total observation time is 20 min. The DAC will expose 96 frames of film for each program performance.  --Program 1d, Ecliptic Poles (N&S) This program is performed from within the earth's shadow. All 10 filters are used. The short duration dark periods resulting from high β angle orbits are well suited to this program. The program requires 10 to 15 min to observe one pole (north or south). The DAC will expose 40 to 72 frames of film for each program performance.  Note: Observe one pole N or S, scan up or down.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 6 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					--Program 1e, Celestial Poles (N&S) This program is particularly important for simultaneously relating OA observations to observations being obtained from the ground support station at Hawaii. All 10 filters are used. The program requires 30 min to observe one pole (north or south). It is estimated



Note: Observe one pole N or S, scan up or down.

- Mode 2 VERTICAL CIRCLE

This mode performs vertical circle scans (scans in trunnion at fixed shaft). At the conclusion of a vertical circle scan, the shutter closes, the next filter moves into position, the shutter opens, and the photometer retraces its steps. This routine is continued until all the filters have been used. The shaft and range of scan in trunnion are preset, as are the number of sequences. Mechanical constraints make it impossible to scan in trunnion ±112.5°. Lower trunnion limit for the -Z (anti-solar) SAL is 0°, and the lower trunnion limit for the +Z (solar) SAL is 15°. When using the +Z SAL, the trunnion scan stops at 15°, the mount rotates in shaft before the trunnion scan continues (in reverse direction) to the other limit.

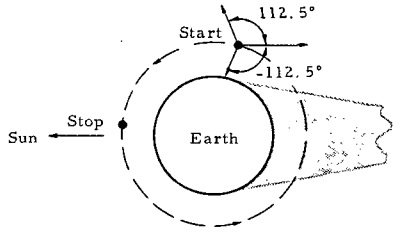
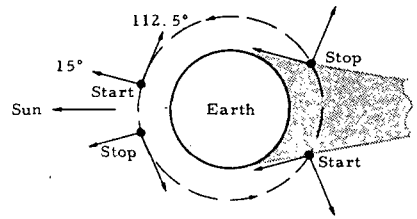
--Program 2a, In Ecliptic (anti-solar view)

This program provides information on contamination back-scattering and on the existence of a gegenschein parallax and is to be performed anywhere outside the earth's shadow.

The photometer scans in trunnion from 112.5° to the anti-solar point at a shaft corresponding to the ecliptic (shaft is 0°). The shaft is rotated from 0 to 180° with the shutter open. The trunnion then scans back to its original starting point which is now located at -112.5°.

The program requires 19 min to complete the observation for all filters (9.5 min for each shaft setting). The DAC will expose 200 frames of film for each program performance.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 7 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					 --Program 2b, Ecliptic (Solar View) In this program the photometer scans in trunnion at a shaft corresponding to the ecliptic from 15 or 20° of the sun to 112.5°. The photometer then rotates 180° after which the scan continues from -112.5 to -15 or -20°. This program is performed in the earth's shadow and is repeated during the daylight portion of the orbit. The program requires a total of 38 min of observation (19 min of observation in the earth's shadow and 19 min in the daylight). The DAC will expose 360 frames of film for each program performance.  --Program 2c, Vertical Circle In this program the photometer scans in trunnion at a shaft corresponding to the ecliptic for at least one scan between the limits of 0 (the anti-solar point) and 112.5°. When the scan limit is reached, the photometer rotates 90° in shaft and scans in trunnion to the other limit. This operation is repeated for each of the

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 8 of 81)

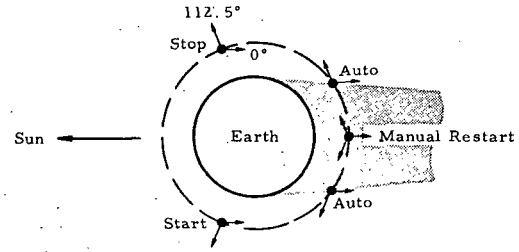
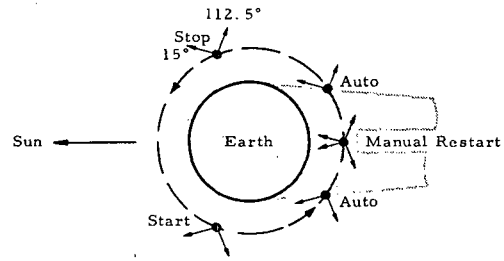
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					10 filters and requires 15 min. Each 15-min scan is repeated four times during one orbit for a total of 60 min being required to complete the observation. The program is started 15 min before entering the terminator and is automatically repeated at the end of the first 15-min scan. This results in one scan in sunlight and one scan in darkness. The shaft values are then manually changed and another two sequences are run. Orbital conditions that result in at least a 30-min dark side pass are highly desirable. The DAC will expose 800 frames of film for each program performance.  --Program 2d, Vertical Circle In this program the photometer scans in trunnion at a shaft corresponding to the ecliptic for at least one scan beginning at 112.5 and continuing to within 15° of the solar point. When the scan limit is reached, the photometer rotates 90° in shaft and scans in trunnion to the other limit. This operation is repeated for each of the 10 filters and requires 15 min. Each 15-min scan is repeated four times during one orbit for a total of 60 min being required to complete the observation. The program is started 15 min before entering the terminator and is automatically repeated at the end of the first 15-min scan. This results in one scan in sunlight and one in darkness. The shaft values are then manually changed and another two sequences are run. Orbital conditions that result in at least a 30-min dark side pass are highly desirable. The DAC will expose 720 frames of film for each program performance.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 9 of 81)

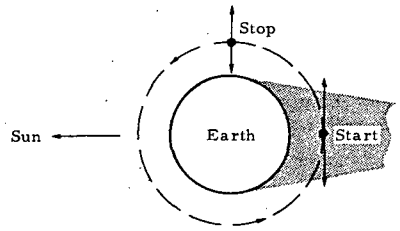
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					

- Mode 3 ALMUCANTAR
  This mode performs almucantar scans (scans in shaft at fixed trunnion). At the conclusion of a scan in shaft, the shutter closes, the next filter moves into position, the shutter opens, and the photometer scans back along the same path. This routine is continued until all the filters have been used. The trunnion and range of scan in shaft are preset, as are the number of sequences.
  --Program 3a, Perpendicular to Ecliptic
  This program is performed inside and outside the earth's shadow. The trunnion is preset to 90° and the photometer scans in shaft through its entire range; i.e., 0 to 354°, 354 to 0°, etc.

  The program requires 17 min to complete the observation. The DAC will expose 80 frames of film for each program performance.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 10 of 81)

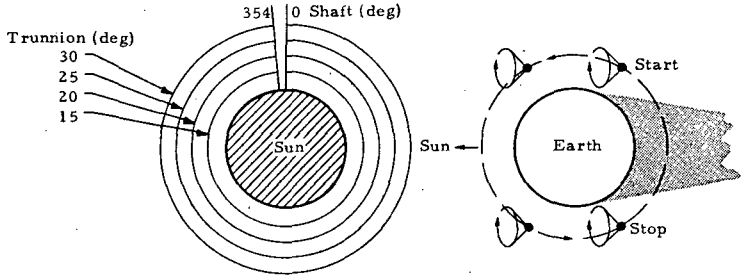
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					



--Program 3b, Contamination

This program is performed at octal equivalents of trunnion 15, 20, 25, and 30°. The photometer scans clockwise (cw); i.e., increases in shaft, with one filter, returns ccw with the next filter, etc.; through the 10 filters at the same trunnion setting. The trunnion is then manually changed to its next position, and the previous set of measurements is repeated.

The program requires 68 min to complete its observations including the manual changing of the trunnion. The DAC will expose 320 frames of film for each program performance.



Note: Typical scan pattern.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 11 of 81)

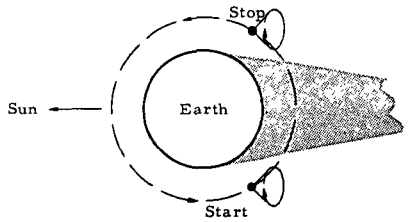
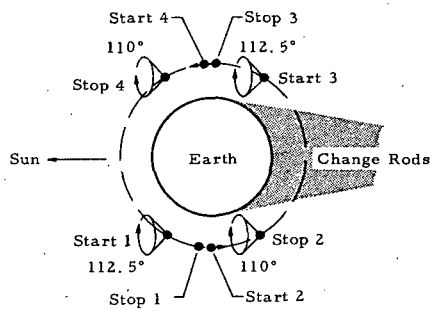
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					--Program 3c, Gegenschein This program is performed in order to examine the wavelength dependence of the gegenschein before changes in brightness occur. The program scans through the entire range of shaft at each of two trunnion angles (2.8 and 4.2°) using all 10 filters. The trunnion must be manually changed. The program requires 34 min to complete including the manual changing of the trunnion angles. The DAC will expose 160 frames of film for each program performance.  --Program 3d, Contamination The purpose of this program is to examine the wavelength dependence of the OA corona before any change in brightness occurs. The program is performed outside the earth's shadow and scans through the entire range of shaft at each of two trunnion angles, 112.5 and 110°, using all 10 filters. The trunnion angles are changed manually. The program requires 34 min to perform; however, for a complete observation, the program is to be performed twice: once with the photometer extended a length of two rods and once with the photometer extended a length of seven rods. The total observation time, including manual trunnion changes, is 68 min and requires an astronaut to monitor intensity and change the gain. The DAC will expose 320 frames of film for each program performance.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 12 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					



- Mode 4 LIMITED SKY MAPPING

  This mode provides detailed maps of limited regions; e.g., near the genenschein or the sun by performing a series of almucantar scans (scans in shaft at fixed trunnion) separated in trunnion by 2.8°. A full mapping is performed with one filter before a mapping with another filter is started.

  --Program 4a, Gegenschein

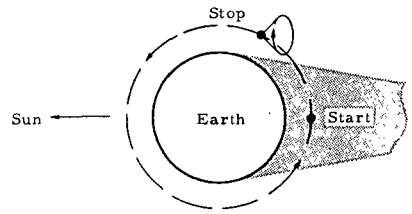
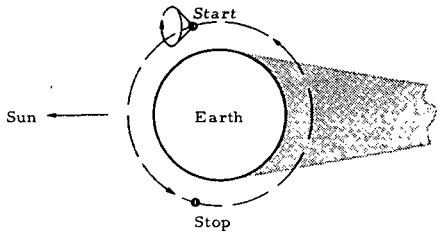
  This program performs concentric scans about the anti-solar direction. The photometer scans over the entire range of 354° in shaft and from 2.8 to 28° in trunnion in steps of 2.8° for one filter. The entire scan is repeated for each of the 10 filters.

  Each scan (1 filter) requires 16 min and is performed in an orbital position to keep the earth out of the FOV. It is desirable to perform part of the program in the earth's shadow but it should not be a constraint to the operation of the program.

  The program requires 160 min to complete, using all 10 filters. Ten orbital passes are desired. The DAC will expose 820 frames of film for each program performance.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 13 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					 --Program 4b, Inner Zodiacal Light/Contamination This program performs concentric scans about the sun to provide information on contamination and on the main cone of the zodiacal light, including high and low galactic latitude regions. The photometer scans over the entire range of 354° in shaft and from 15 to approximately 70° in trunnion in steps of 2.8°. The entire scan is repeated for each of the 10 filters. Each scan (1 filter) requires 32 min and is performed during the lighted portion of the orbit. To complete the program, using all 10 filters, requires 320 min and 10 orbits. The DAC will expose 1600 frames of film for each program performance. 

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 14 of 81)

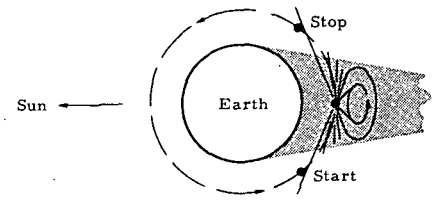
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Continued)					• Mode 5 ALL SKY MAPPING This mode is used to provide maps of the sky by performing a series of almucantar scans (scans in shaft at fixed trunnion) separated in trunnion by 5.6°. A full mapping is performed with one filter before a mapping with another filter is started. --Program 5a, All Sky Map This program performs concentric scans in the anti-solar direction. The photometer scans over the entire range of 354° in shaft and from 2.8 to 112.5° in trunnion in steps of 5.6° for one filter. The entire scan is repeated for each of the 10 filters. Each scan (1 filter) requires 32 min. To complete the program, using all 10 filters, requires 320 min and 10 orbits. It is estimated that the DAC will expose 1600 frames of film for each program performance.  --Program 5b, All Sky Map This program maps the entire sunward sky over the entire range of 354° in shaft and 15 to 112.5° in trunnion in steps of 5.6° for one filter. The entire scan is repeated for each of the 10 filters. Each scan (1 filter) requires 29 min. To complete the program, using all 10 filters, requires 290 min and 10 orbits. It is estimated that he DAC will expose 1520 frames of film for each program performance.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 15 of 81)

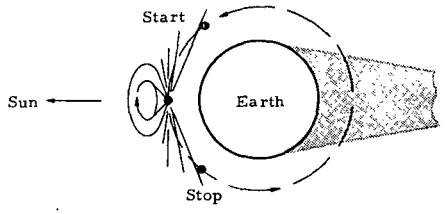
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1 (Concluded)					 • Mode 6 STOWAGE POSITION RETURN It is necessary to position elevation to 0° and azimuth to 45° before the universal extension mechanism, orientation mechanism, photoelectric photometer, and camera system can be returned to the canister. The basic system does not contain stops for both the azimuth and elevation positions required for stowage, and it is not possible to stop at a given position except by manually scanning back and forth until the mount happens to stop on the exact bit of the encoder. This mode automatically returns the mounting from its position at the end of any program to the azimuth and elevation that are required for retraction into the canister. References 1 through 9.
3.1.1 Specify duration that the experiment is required to operate and provide useful information.		100.03 hr/ Skylab Mission		N/A	The experiment is operated at selected periods during the SL-1/SL-2, SL-3, and SL-4 missions. Once the photometer is deployed, anywhere from one to four scans a day may be accomplished before it is retracted. For the SL-1/SL-2 mission, it is desired to begin the experiment on day of year (DOY) 125 and terminate on DOY 145. Ten days of the 28 day mission are scheduled for operating the experiment. Twenty-three scans are expected to be accomplished during the 10 day operating period, however, fifteen scans are considered the minimum scheduling requirement. The scan time for Skylab mission SL-1/SL-2 is: • Minimum scheduling requirement, fifteen scans (mandatory and highly desirable FO's) --Net Observing Time 11.71 hr --Net Calibration Time 1.57 hr --Total Observing and Calibration Time 13.28 hr • Baseline scheduling requirement, twenty-three scans (mandatory, highly desirable, and desirable FO's) --Net Observing Time 14.19 hr --Net Calibration Time 3.14 hr --Total Observing and Calibration Time 17.33 hr

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 16 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.1 (Continued)					

- Minimum and baseline scheduling requirements:

FO	Program	SAL	No. of Rods	Performance Time (min)	Crew Requirements	Remarks
1	0a	S*	7	94		FO-1 highly desirable prior to ATM
2	0a	A*	2	94		
3	0a	S	7	94		
4	0a	S	7	94		
5	1a	S	2,7	40	Monitor PMT intensity, change rods	CMG dump inhibit required. FO-5 highly desirable prior to ATM. Power and telemetry on during rod changes.
6	1a	A	2,7	40	Change rods	CMG dump inhibit required. Power and telemetry on during rod changes.
7	1a	S	2,7	40	Change rods	CMG dump inhibit required. Power and telemetry on during rod changes.
8	1a	A	2,7	40	Change rods	CMG dump inhibit required. Power and telemetry on during rod changes.
9	3b	S	7	68	Change trunnion angles	Perform at least 5 days after Program 4b (FO-22).
10	3d	A	2,7	68	Change trunnion angles Monitor PMT intensity Change gain and rods	Perform near end of mission. Power and telemetry on during rod changes.
11	2a	A	2	19		CMG dump inhibit required. FO-11 and 12 should be performed no more than 2 days apart.
12	2b	S	7	38		CMG dump inhibit required. FO-11 and 12 should be performed no more than 2 days apart.
13	2c	A	2	60	Change shaft angles	CMG dump inhibit required. Greater than 30 min dark side pass is highly desirable. FO-13 and 14 should be performed at least 1 day apart.
14	2d	S	7	60	Change shaft angles	CMG dump inhibit required. Greater than 30 min dark side pass is highly desirable. FO-13 and 14 should be performed at least 1 day apart.
15	5a	A	2	320		Requires use of orbital counter
16	5b	S	7	290		Requires use of orbital counter
17	1e	A	2	30		Hawaii coordination, new moon ± 1 week, and CMG dump inhibit required.
18	1c	A	2	30		CMG dump inhibit required.
19	1b	A	2	48		Hawaii coordination, new moon ±1 week, and CMG dump inhibit required.
20	4a	A	2	160		Requires use of orbital counter. May be performed during day off or sleep period.
21	3a	A	2	17		CMG dump inhibit required.
22	4b	S	7	320		Hawaii coordination required. Perform at least 5 days before Program 3b (FO-9).
23	1d	A	2	15		Hawaii coordination and CMG dump inhibit required.

*S = Solar; A = Anti-solar

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 17 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.1 (Concluded)					For SL-3, it is desired to commence experiment operating scans on mission day 214. A total of 20 days out of the 58 day mission are scheduled for experiment operations. Forty-five scans are expected to be accomplished during the 20 day period: Net Observing Time 44.57 hr Net Calibration Time 1.42 hr Total Observing and Calibration Time 45.99 hr Skylab mission SL-4 corollary experiment scheduling usage is TBD. However, it is expected that experiment total observing and calibration times will be similar to that of mission SL-3. Overall experiment operating duration for a 50 day period out of 144 Skylab mission days (using minimum scheduling requirements for SL-1/SL-2) is calculated at: Total Observing Time 100.85 hr Total Calibration Time 2.46 hr Total Observing and Calibration Time 103.31 hr References 1 and 7 through 11.
3.1.2 Specify the types of criteria that are to be maximized or minimized.				N/A	The Functional Objectives (FO) for the Contamination Measurement, Photometer and Gegenschein/Zodiacal Light (T-027/S-073) experiment are: SL-1/SL-2 • FO-1 through FO-4: Perform System Monitor Program 0a • FO-5 through FO-10: Perform Contamination Programs 1a (FO-5 through FO-8), 3b (FO-9), 3d (FO-10) • FO-11 and FO-12: Perform in Ecliptic Programs 2a (FO-11) and 2b (FO-12) • FO-13 and FO-14: Perform Vertical Circle Programs 2c (FO-13) and 2d (FO-14) • FO-15 and FO-16: Perform All Sky Map Programs 5a (FO-15) and 5b (FO-16) • FO-17 and FO-18: Perform Celestial Poles (N and S) Program 1e • FO-19 and FO-20: Perform Gegenschein Programs 1b (FO-19) and 4a (FO-20) • FO-21: Perform Perpendicular to Ecliptic Program 3a • FO-22: Perform Inner Zodiacal Light/Contamination Program 4b • FO-23: Perform Ecliptic Pole (N) Program 1d SL-3 • FO-1 through FO-4: Perform System Monitor Program 0a (FO-1 through FO-4) • FO-5 through FO-14: Perform Contamination Programs 1a (FO-5 through FO-10), 1c (FO-11), 3b (FO-12 and FO-13), and 3d (FO-14) • FO-15 through FO-20: Perform In Ecliptic Programs 2a (FO-15 through FO-17) and 2b (FO-18 through FO-20) • FO-21 through FO-24: Perform Vertical Circle Programs 2c (FO-21 and FO-22) and 2d (FO-23 and FO-24) • FO-25 through FO-26: Perform All Sky Map Programs 5a (FO-25) and 5b (FO-26) • FO-27 through FO-32: Perform Celestial Poles (N&S) Program 1e (FO-27 through FO-32) • FO-33 through FO-39: Perform Gegenschein Programs 1b (FO-33 through FO-35), 3c (FO-36 and FO-37), and 4a (FO-38 and FO-39) • FO-40 through FO-42: Perform Perpendicular to Ecliptic Program 3a (FO-40 through FO-42) • FO-43: Perform Inner Zodiacal Light/Contamination Program 4b • FO-44 through FO-45: Perform Ecliptic Poles (N&S) Program 1d (FO-44 and FO-45)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 18 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
					SL-4 • FO-1: Perform seven photometer program scans from the solar SAL (programs 1a, 0a, 2a, 3b, 2b, 5b, and 1a) • FO-2: Perform eight photometer program scans from the anti-solar SAL (programs 1a, 2b, 2a, 0a, 1e, 1b, 3a, and 5a) • FO-3: Perform five photometer program scans from the anti-solar SAL (programs 1d, 1d, 1e, 3c, 4a) • FO-4: Perform four photometer program scans from the solar SAL (programs 0a, 2a, 2b, and 4b) • FO-5: Perform seven photometer program scans from the anti-solar SAL (programs 1b, 1e, 2a, 3a, 2b, 1e, and 4a) • FO-6: Perform four photometer program scans from the solar SAL (programs 1a, 0a, 2a, and 3b) • FO-7: Perform 10 photometer program scans from the anti-solar SAL (programs 1b, 1e, 2a, 1a, 3d, 1a, 3a, 1e, 3c, and 1c). References 1, 2, 3, and 71.
3.1.3 Specify the percentage of acceptable max./min. for each objective.	100%			N/A	SL-1/SL-2 If the T-027/S-073 minimum requirement is met without compromise, it is maximized at 100 percent. This means that 15 scans were accomplished. If the T-027/S-073 baseline schedule requirement is met without compromise, then a greater mission benifit is realized. This means that 23 scans were accomplished. If the optimal requirement is met, 45 scans were accomplished. No attempt is made to define the minimum percentage of acceptability for the above requirements. SL-3 and SL-4 The baseline requirements for both missions are 45 program scans. References 1, 7, 8, 9, and 11.
3.1.4 Specify experiment constraints: • Musts • Must Nots • Wants • Don't Wants.				N/A	• Musts --An astronaut must set up mode sequences, limit values for shaft and trunnion, appropriate switches, and initiate the scan sequences. --All exterior OA lights are turned off. All OA and Command Module (CM) windows that would interfere with experiment operation must be covered during data collection. --The film magazine must be placed in the Orbital Workshop (OWS) film vault before and after exposure and returned to earth in the CM. --Major maneuvers of the OA must not occur during experiment data collection. --After applying power to the photometer system, a 5 min warmup time is required prior to data collection. --After recovery, the magazine containing exposed film delivered to the Photographic Division at the Manned Spacecraft Center (MSC). --When the photometer is installed in the anti-solar SAL, the electrical power must be left on when not in a data taking mode. --The photometer must be inside the SAL with the SAL door closed during and for at least 30 min after any hot gas thruster firing. --Experiment and selected spacecraft systems measurements must be recorded for subsequent playback and transmission to the ground. --The astronaut must voice record and time correlate comments relevant to experiment operation. --Experiment M-151 photography is required only one time each during setup and removal from each SAL. --Twenty-three baseline scans are scheduled for SL-1/SL-2. However, 15 scans will meet the minimum scheduling requirement. A total of 45 scans is considered the optimum scheduling requirement.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 19 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Continued)					

Early Mission				Mid Mission				Late Mission			
+Z SAL		-Z SAL		+Z SAL		-Z SAL		+Z SAL		-Z SAL	
Program	FO	Program	FO	Program	FO	Program	FO	Program	FO	Program	FO
1a	5†	1a	6†	0a	3*	1b	19	1a	7*	3d	10*
0a	1†	0a	2†	2d	14*			3b	9	3a	21
2b	12†	2a	11†	5b	16			0a	4*	1a	8*
4b	22†	5a	15†								
		1d (N)	23								
		1e (N)	17								
		4a	20								
		1e (S)	18*								
		2c	13*								

†It is mandatory that these program FO's be performed early in the mission. It is highly desirable that the remaining FO's be performed at the indicated times.

*Program FO's to be deleted to meet minimum scheduling requirements should be deleted in the following order: 13, 4, 8, 18, 3, 14, 10, and 7.

--Program 0a

-This program must be performed four times during the mission: once each from the solar (+Z axis) and anti-solar (-Z axis) SAL's early in the mission, and once each from the +Z SAL at mid-mission and late mission. The performances at mid-mission and late in the mission are highly desirable, whereas the others are mandatory.

-When Program 0a is performed from the solar SAL for the first time (FO-1), it is mandatory that Program 1a (FO-5) be performed during the same SAL deployment period. It is highly desirable that these initial performances occur prior to the beginning of the Apollo Telescope Mount (ATM) experiment operation.

-When this program is performed from the +Z SAL, the photometer must use seven extension rods, and when deployed from the -Z SAL, the photometer uses two rods (A rod and C rod).

--Program 1a

-This program is performed four times during the mission; once from each SAL early in the mission, once from the -Z SAL at mid-mission, and once from the +Z SAL late in the mission. The performances from the solar and anti-solar SAL's late in the mission are highly desirable, whereas the others are mandatory.

-When Program 1a is performed from the solar SAL for the first time (FO-5), it is mandatory that Program 0a (FO-1) be performed during the same SAL deployment period. It is highly desirable that these initial performances occur prior to the beginning of ATM experiment operation.

-When the photometer is deployed from the +Z SAL, seven extension rods must be used; when deployed from the -Z SAL two rods (A rod and C rod) must be used.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 20 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Continued)					-During the entire first performance (FO-5) a crew member must be present to monitor Photomultiplier Tube (PMT) intensity and gain. -The CMG dump must be inhibited. -For one-half (i.e., 20 min) of each performance of Program 1a (FO-5 through FO-8) the photometer will be at seven rods. The remaining half will be at two rods. The order of performance must be consistent with temperature requirements. Power and telemetry must be left on when changing rod lengths. --Program 1b -This program is performed from the -Z SAL one time during mid-mission, and is considered highly desirable. -The CMG dump must be inhibited. --Program 1d -This program is performed one time early in the mission from the -Z SAL. This performance is an observation of the N ecliptic pole and is highly desirable. -The program must be performed with the photometer deployed at seven rods. -The CMG dump must be inhibited. --Program 1e -This program must be performed two times early in the mission from the -Z SAL. The performance that observes the N celestial pole is highly desirable and the performance that observes the S celestial pole is desirable. -All observations must be made with the photometer deployed at two extension rods (A rod and C rod). -The CMG dump must be inhibited. --Program 2a -This program is performed from the -Z SAL one time early in the mission and is considered mandatory. -The program must be performed with the photometer deployed at two extension rods (A rod and C rod). -The CMG dump must be inhibited. --Program 2b -This program is performed one time from the +Z SAL early in the mission and is considered mandatory. -The program is performed with the photometer deployed at seven extension rods. -The CMG dump must be inhibited. --Program 2c -This program is performed from the -Z SAL one time early in the mission. This performance is desirable. -The program must be performed with the photometer deployed at two rods (A rod and C rod). -The CMG dump must be inhibited. --Program 2d -This program is performed from the +Z SAL one time during mid-mission and is considered desirable.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 21 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Continued)					-The program is performed with the photometer deployed at seven extension rods. -The CMG dump must be inhibited. --Program 3a -This program is performed one time late in the mission from the -Z SAL and is considered highly desirable. -The program must be performed with the photometer deployed at two rods (A rod and C rod). -The CMG dump must be inhibited. --Program 3b -This program is performed only one time late in the mission from the +Z SAL and must be considered highly desirable. -The program is performed at least 5 days after Program 4b. -The program requires a crew member for 1 min each 15 min to change trunnion settings. -The program must be performed with the photometer deployed at seven rods. --Program 3d -This program is performed from the -Z SAL one time late in the mission and is considered desirable. -The deployment of the photometer from the -Z SAL is accomplished two times: once at seven rods extension and once at two rods extension (A rod and C rod). -Power and telemetry must be left on when changing rod lengths. -A crew member is required to monitor the PMT intensity, change the gain, deploy and change extension rods, and set the trunnion. --Program 4a -This program is performed one time early in the mission from the -Z SAL and is considered highly desirable. -The program must be performed with the photometer deployed at two rods (A rod and C rod). -The program uses the orbital counter and may be performed during a crew day off or a sleep period. --Program 4b -This program is performed one time early in the mission from the +Z SAL and is considered mandatory. -The program *must* be performed at least 5 days before Program 3b. -The program uses the orbital counter. -The program is performed with the photometer deployed at seven rods. --Program 5a -This program is performed one time early in the mission from the -Z SAL and is considered mandatory. -The program must be performed with the photometer deployed at two rods (A rod and C rod). -This program uses the orbital counter.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 22 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Continued)					--Program 5b -This program is performed one time at mid-mission from the +Z SAL, and is considered highly desirable. -This program must be performed with the photometer deployed at seven rods. -This program requires the use of the orbital counter. • Must Nots --The T-027/S-073 photometer will use both SAL's. The SAL's will also be used by Experiments S-019 (Ultraviolet Stellar Astronomy), S-020 (Ultraviolet/X-Ray Solar Photography), S-063 (Ultraviolet Airglow Horizon Photography), S-149 (Particle Collection), S-183 (Ultraviolet Panorama), S-190B (Earth Terrain Camera), T-025 (Coronograph Contamination Measurements), T-027 (Sample Array System) and the operational Portable Color Television System (PCTVS). No two experiments can be scheduled concurrently at the same SAL. --Experiment T-027/S-073 orientation/extension mechanism is also used by Experiment S-149 and the PCTVS and cannot be scheduled concurrently. --Experiment T-027/S-073 cannot be scheduled concurrently with M-092 (Inflight Lower Body Negative Pressure), M-093 (Vectorcardiogram), and M-171 (Metabolic Activity) because of the requirement for 320-sample/sec data channels in the Airlock Module (AM). Experiments M-092 and M-171 use M-093 vectorcardiogram hardware. --The photometer must not be pointed within 15° of the moon or the sun during experiment data taking. --The photometer must not be scheduled concurrently with experiment M-509 (Astronaut Maneuvering Equipment). The M-509 experiment will use the same tape recorder as used by the T-027/S-073 experiment. • Wants --Should more time be made available to the experiment during the SL-1/SL-2 mission, real-time scheduling of additional photometer scans can be programmed to operate in accordance with the following maximum scan requirements.

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 23 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Continued)					

Early Mission		Mid-Mission		Late Mission	
+Z SAL	-Z SAL	+Z SAL	-Z SAL	+Z SAL	-Z SAL
1a	1a	0a	1b	1a	1b
0a	2c	2b	1e	0a	1e
2b	2a	2d	2a	2b	2a
3b	0a	4b	3a	3b	1a
2d	1e		2c		3d
5b	1b		1e		1a
1a	3a		4a		3a
	5a				1e
	1d				3c
	1d				1c
	1e				
	3c				
	4a				

The above schedule is used to accomplish the operating scans on missions SL-3 and SL-4.

--The photometer head temperature should be above the dewpoint before the film magazine is removed in order to avoid fog or frost on the optics and to prevent acceleration of corrosion caused by excess moisture on precision surfaces and delicate components.

--It is not mandatory that an astronaut be present during scan sequences. However, when other duties permit, it will be highly desirable for an astronaut to monitor detector signal levels and programmer functions and make verbal and/or written record relative to experiment operation. This particularly applies to any condition which might degrade results, such as changes in the optical environment around the OA.

--The performances of programs 1d, 1e, 4a, 5b, 1b, 3b, and 3a have been designated as highly desirable. However, if time is not available to accomplish the above scans, they should be performed in the following order: 1d, 3b, 4a, 1b, 3a, 5b, and 1e.

--The performance of programs 0a (FO-3), 0a (FO-4), 1a (FO-7), 1a (FO-8), 3d (FO-10), 2c (FO-13), 2d (FO-14), and 1e (S) (FO-18) have been selected for deletion to meet the minimum scheduling requirement. Because it may not be necessary to delete all eight programs, they should be deleted in the following order: 2c (FO-13), 0a (FO-4), 1a (FO-8), 1e (S) (FO-18), 0a (FO-3), 2d (FO-14), 3d (FO-10), and 1a (FO-7).

--Program 1b
  -It is highly desirable that the performance be made within 1 week of the new moon and coordinated with ground observations at Hawaii.

--Program 1c
  -This program has the lowest priority and should be run on a time available basis.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 24 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.4 (Concluded)					--Program 1d -The performance of this program should be coordinated with ground observations at Hawaii. --Program 1e -The N and S celestial pole observations should be separated by no more than 2 days. It is highly desirable that the N celestial pole observation be within 1 week of the new moon and coordinated with ground observations at Hawaii. --Program 2a -Programs 2a and 2b should be considered as a pair and performed as close together as possible with a maximum of 2 days separation between performances. --Program 2c -There should be a separation of at least 1 day between performances of programs 2c and 2d. -Dark side passes greater than 30 min in duration are highly desirable. --Program 4a -If scheduling is a problem because of the 10 orbit requirement, the orbits may be reduced to 8. --Program 4b -The performance of this program should be coordinated with ground observations at Hawaii. -If scheduling is a problem because of the 10 orbit requirement, the orbits may be reduced to 8. --Program 5a -This program should be performed during the first deployment of the photometer from the anti-solar SAL because of its high priority. -If scheduling is a problem because of the 10 orbit requirement, the orbits may be reduced to 8. --Program 5b -This program is performed from the +Z SAL one time during mid-mission, and is considered highly desirable. -If scheduling is a problem because of the 10 orbit requirement, the orbits may be reduced to 8. • Don't Wants --When mounted at either SAL, the photometer canister will protrude into the operational volume required by T-020 (Foot Controlled Maneuvering Unit) and M-509. At the anti-solar SAL it will protrude into the T-013 (Crew/Vehicle Disturbances) operational volume. References 1, 7, 8, 9, 10, and 12.

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 25 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.1.5 Specify experiment operational tolerances: • Musts • Must Nots • Wants • Don't Wants.				N/A	• Musts --The maximum allowable scan rate error in shaft or trunnion during data gathering is ±0.025 deg/sec. --Use moderate hand torque when assembling the photometer extension rods (approximately 40 in. /lb; design limit 160 in. /lb maximum).
				N/A	• *Must Nots* --The photometer must not be pointed within 15° of the sun or moon during data collection modes.
				N/A	• Wants --Solar inertial or any other known inertial orientation *is most desirable. Inertial* orientation modes with random rates below 0.05 deg/sec are preferred. Constant rates up to 0.1 deg/sec scaler changes in orientation are acceptable if they do not result in a loss of the designated target. --Angular accelerations that result in rates less than 0.05 deg/sec are acceptable.
				N/A	• Don't Wants --The total radiation dosage for each film magazine should not exceed 5 rad. --The film magazines should not exceed 80 °F. References 1, 7, 10, and 12.
3.2 Define decision rules and success criteria for experiment objectives.				N/A	If the experiment is aborted, then the probability of success (P_s) is equal to 0.0. If the *experiment is compromised* and minimum information is salvaged, $P_s = 0.1 \rightarrow 0.5$; if maximum information is salvaged, $P_s = 0.5 \rightarrow 0.9$. If the experiment is completed as scheduled $P_s = 1.0$.
	8 scans 8.05 hr	15 scans 13.28 hr	23 scans 17.33 hr		Mission SL-1/SL-2 The T-027/S-073 photometer system is expected to be *deployed between* 8.05 and 17.33 hr during the mission. This calculation is based on the assumption that the experiment will be started early in the mission. Experiment operations are expected to terminate 5 days before SL-2 reentry. Twenty-three scans are scheduled; however, 15 scans are expected *to be accomplished. Eight* of the 23 scans are mandatory, 7 scans are highly desirable, and 8 scans are desirable. This constitutes the PI's baseline scanning requirement. The eight scans represent a 34.8 percent accomplishment of FO-1 through FO-23. Fifteen scans would represent a 65.2 percent accomplishment of FO-1 through FO-23.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 26 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.2 (Continued)	Percentage of Success for				The success criteria for the scan performances are:

Minimum Scans (15)		Baseline Scans (23)	
FO	Program	FO	Program
5	1a		
1	0a		
12	2b		
22	4b		
6	1a		
2	0a		
11	2a		
15	5a	Minimum scans plus eight scans as shown below:	
23	1d		
17	1e (N)		
20	4a		
16	5b		
19	1b		
9	3b		
21	3a		
		7	1a
		10	3d
		14	2d
		3	0a
		18	1e (S)
		8	1a
		4	0a
		13	2c

Mission SL-3

The mission timeline has not been fully developed, however, 45 scans are expected to be accomplished over a 56 day period.

Mission SL-4

The mission timeline has not been fully developed, however, 45 scans are expected to be accomplished over a 56 day period.

References 1, 7, 9, and 11.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 27 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.3 Specify experiment priority (numberical statement) for a given Skylab flight designation.					The Contamination and Gegenschein/Zodiacal Light Photometer FO-1 through FO-10 are scheduled for flight on SL-1/SL-2, SL-3, and SL-4. The flight scheduling (priority) number is expected to be 410 for all missions. The priority value indicates the *relative* importance of the experiment as related to the Skylab mission flight. The priority value is subject to change. References 11, 13, and 14.
3.4 List and briefly describe the major subsystems for Experiment T-027/S-073.				N/A	Refer to functional items 3.4.1 and 3.4.2.
3.4.1 Describe the major functions.				N/A	The T-027 photometer system is designed for use on the Skylab OA to study the nature and extent of contaminants surrounding the OA and investigate the celestial and earth skyglow phenomena. An extendable Universal Extension Mechanism (UXM) is provided to deploy a photoelectric photometer system (photometer head assembly) through a SAL located in the OWS. The photometer head assembly is mounted on a gimbal system at the end of the UXM to permit scanning in azimuth and elevation. During operation, the photometer canister assembly is mouhted to either a +Z or -Z SAL, and the UXM is extended manually by using a series of extension rods which are passed through O-ring seals at the rear of the experiment canister mechanical control panel. The canister also provides control panels for the operation of the photometer head, Experiment S-149, and the pointing of the PCTVS. The photometer head contains an optical train with a polarizing disc, ten selectable interference filters, a FOV system, and a PMT to sense and analyze the integrated light entering the system. A radioactive calibration source is also provided to allow automatic system calibration. References 10, 12, 15, and 16.
3.4.2 List major components.				N/A	The major subsystem components are: • Canister Assembly • Control Panels • Extension and Ejection Rods • Photometer Head Assembly • Orientation Mechanism • UXM (also referred to as a mast assembly) • Power Supply • Storage Container

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 28 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.4.2 (Concluded)					References 10 and 15 through 19.
3.5 Define the T-027/S-073 experiment/carrier subsystem interfaces: • Physical --Mechanical --Electrical --Communications and Data --Support • Environmental --Natural and Induced --Contamination • Operational --Pointing and Control --Crew Safety --Sequence --Operability.				N/A	A Functional Block Diagram (FBD) is submitted as Figure T-1 and is used as a subsystem component listing. Only critical subsystem components are identified and evaluated for failure, and are correlated to possible experiment/carrier interface problems. References 16 and 20.
3.5.1 Photometer System				N/A	Refer to functional item 3.5.1.1.
3.5.1.1 Specify the net probability of failure (Pf_n) and the total probability of failure (Pf_t) for the canister shell assembly (external).		$Pf_t = 0.4$		II	The canister shell is made of aluminum and has an external size of approximately 52 in. long and 9.5 in. square. The internal volume of the canister accepts the retracted UXM and the photometer head, PCTVS camera, or S-149 micrometeorite particle collection cassettes. With the photometer head retracted into the canister shell and the end plate secured, the internal canister volume is sealed. The common control panel and the relay and driver assembly are permanently fastened to the canister whereas the manual control panel and the automatic programmer are detachable. A shorting plug is stowed on the canister shell assembly. The plug is connected to the manual control panel whenever the cable from the automatic programmer is not attached. In this configuration, the photometer can be operated either manually, in a filter change/camera automatic sequence mode, or in a separate camera automatic sequence. Attached to the canister shell are: • Control panels • Extension/ejection rod holder • Extension rods • Extension rod/carrying handle

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 29 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1 (Continued)					• Ejection rod • Slewing handle • Ejection rod pivot latch and retaining pin • Tube plug • PMT and DAC sunshield dust covers • Photometer head electrical connector dust cap • Canister/SAL seals • Cover plate • Tripod mounting interface. The probability of failure (P_f) for the canister shell assembly is considered small. If the canister shell assembly should fail, the following situations could occur:
		$Pf_n = 0.14$			• Mechanical --The structural design is not expected to be subject to severe pressure loading when operated in the OWS/SAL environment. • Communications and Data --If the structural integrity of the canister assembly fails, the crew is expected to discontinue the experiment so as not to compromise crew safety. Telemetry data will be lost. • Support --If the structural integrity of the canister or canister/SAL interface fails, it will not be possible to deploy the S-149 experiment and the PCTVS.
		$Pf_n = 0.26$			• Crew Safety --The canister shell assembly is interfaced to either SAL for experiment operation. Normally a tripod assembly would be secured to the OWS floor directly below the canister to inhibit X axis movement of the canister. However, if the tripod failed, the canister would be mounted to the SAL as a cantilever beam. This condition imposes a safety problem insofar as crew operating procedures are concerned. If the tripod cannot be repaired to support the canister, the experiment will be terminated. Preliminary structural analysis indicates that the OWS/SAL wall interface might yield if 173 lb were loaded on the canister shell assembly (measured 52 in. from the SAL/canister flange interface). The Vehicle Analysis Section (S&E-ASTN-ASV) suggests that no load greater than 125 to 150 lb be applied at anytime to the aft end of the canister assembly (when mounted in the SAL) without the support of the tripod. Therefore, a crew member must not push off from the canister, especially when the canister is unsupported by the tripod. • Operability --The canister assembly can be isolated from crew activities if the photometer head and UXM cannot be retracted. If desired, the crewmen can rope off the immediate area

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 30 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1 (Concluded)					about the SAL and protruding canister assembly by using tethers, straps, and bungees. The following indications can be used to determine the failure of the canister shell assembly: • If excessive loading is experienced on the end of the canister shell assembly (assuming that the tripod assembly failed, the canister may show evidence of gross misalignment with the SAL/OWS wall. The canister assemlby axis system will not be normal to the SAL/OWS wall, and can probably be observed by a crew member. • As in the above case, if excessive loading occurs and it is enough to fracture the OWS wall, a loss of OWS atmosphere will be experienced. If the atmosphere cannot be contained, the crew members must evacuate the OWS to the Multiple Docking Adapter (MDA), seal off the area, and rely on the Command Service Module (CSM) life support system. References 18, 19, 21, 22, 23, and 72.
3.5.1.1.1 Specify the P_{f_n} and P_{f_t} for the extension/ejection rod holder.		$P_{f_t} = 0.09$ $P_{f_n} = 0.05$ $P_{f_n} = 0.04$		N/A	The extension/ejection rod holder mounts on top of the canister and provides for storage of seven extension rods and one ejection rod. The rod holder consists of two bracket assemblies: the mechanical control panel area end bracket guides the rods, and the manual control panel area end bracket attaches the extension rods when turned in a cw direction. The ejection rod is also held secure by a retainer pin/pivot bracket arrangement located on the mechanical control panel. To remove the ejection rod from the rod holder, the crewman must first unlatch the safety pin, remove it, and pivot the bracket segment leftward. The P_f for the rod holder is considered remote. However, if the manual control panel area end bracket should fail or the rod plug receptacle thread become stripped, it could cause the following problems: • Mechanical --The extension rods cannot be attached for storage. --The ejection rod cannot be securely stabilized with only one bracket. • Support --If the rods cannot be removed from the holder, the S-149 experiment or PCTVS cannot be deployed or ejected from the OA. • Crew Safety --Because the ejection rod contains a loaded spring, it should not be subjected to impact or rough handling that might inadvertently cause the ejection tube knob to back out ccw and release the separable rod section. If the forward ejection rod segment becomes separated, it could be propelled into the OWS wall or hardware, or might injure a crewmember. The following indications can be used to determine the failure of the extension/ejection rod holder: • An extension rod will not attach to the plug receptacle when turned cw or the rod cannot be removed when the crew member turns the rod ccw.

MSFC - One-Time Form 22 (July 197-)

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 31 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.1 (Concluded)					• The ejection rod may be binding against the front and back holder brackets, thereby causing the retainer pin to bind between the ejection tube knob and the retaining bracket. The crew member would find it difficult to remove the ejection rod retaining pin. References 15 and 18.
3.5.1.1.2 Specify the P_{f_n} and P_{f_t} for the extension rods.		$P_{f_t} = 0.38$ $P_{f_n} = 0.19$		IIIa	The extension rods provide the means for deploying the UXM and the photometer head into space. There are seven extension rods: one fwd rod designated A, five center rods designated B, and one aft rod designated C. Rods A through B are the same size in diameter and length. Rod C is the same size in diameter as rods A and B, but slightly shorter in length. There are six index pins on the front end of each extension rod and six holes on the back end of the rod that receive the pins from the succeeding rod. The pins align the threads in the rods for exact mating. The back end of the C rod has only four holes to accept the pins from the slewing handle. All the extension rods have a stripe to indicate when the photometer has been fully retracted. A mark is available on each rod (approximately 3 in. from the back end) to indicate the point to which the rod must be retracted before the extension rod handle can be attached to the rod. All rods and the UXM mast support tube have alignment stripes to match when assembling the rods. Rod A is the only rod that can be attached to the UXM mast support tube. Full seven-rod deployment of the mast out of the canister is accomplished by connecting rod A to the UXM mast support tube which protrudes out of the canister. The extension rod LATCH must be latched to complete attaching the rod. After deploying the rod, the extension rod handle is removed and attached to the next rod for deployment. A tube brake is used to clamp the mast in place when attaching or removing extension rods. All remaining rods are deployed in this manner. After the last rod is deployed, it is further extended (approximately 3 in.) and preloaded by rotating the slewing handle cw. Two-rod deployment is similar except that only the A and C rods are used and the mast is not preloaded. The P_f for the extension rods appears to be small. If the rods should fail, the following situations could happen: • Mechanical --If an extension rod inner or outer tube assembly is broken, or the rod index pins are ben it will not be possible to connect the rod or apply a preload to it. If the rod is excessivel warped, it may not be possible to extend or retract the rod through the mechanical control panel. The photometer head cannot be deployed or retrieved. • Communications and Data --If the extension rods cannot be assembled for photometer head deployment from either SAL, the experiment will be terminated. --If the extension rods cannot be configured (extended seven rods and fully preloaded) for photometer head deployment from the solar SAL (+Z axis), the photometer cannot perfor

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 32 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.2 (Concluded)		$P_{f_n} = 0.19$			its scanning programs. The photometer calibration program can be accomplished. A major loss of telemetry measurement data can be expected for the Contamination and Zodiacal Light/Gegenschein scan programs. Experiment S-149 and PCTVS measurement data and information would also be lost. --If the extension rods cannot be configured for two photometer head deployment from the anti-solar SAL (-Z axis), the photometer cannot perform its scanning programs. The photometer calibration can, however, be accomplished but a minor loss of telemetry measurement data would be expected. Zodiacal light/ gegenschein program data and Experiment S-149 measurement data would be lost. • Support --If the extension rods cannot be configured (extended seven rods and fully preloaded) for the S-149 experiment or PCTVS deployment from the solar SAL, both the experiment and television operations would be lost. If the A and C rods cannot be assembled to support the anti-solar SAL deployment of Experiment S-149, then the experiment would be lost. • Operability --It is possible to inadvertently deploy the extension rod through the mechanical control panel, so that the rod is lost, if the crew member does not follow the rod deployment procedures. The following indications can be used to determine the failure of the extension rods: • The crew members rod index pins do not align and engage into the previously assembled rod. Visual inspection of rod index pins can verify the problem. • The extension rod handle, when turned, cannot engage or disengage the rod's forward threaded section into the preceeding rods. This means that the inner rod is broken, or thread damage has occurred. The extension rods cannot be attached to the UXM mast suppport tube or preceeding rod. If the rod was deployed, the crewman could not detach the rod when turning ccw. • Excessive warpage of extension rod may cause the inner rod to bind against the wall of the outer rod. Rod warpage may be so severe that binding occurs when trying to deploy or retrieve the rod through the mechanical control panel. The crewman could not push the rod forward or pull it inboard. • If the extension rod is pushed through the mechanical control panel access hole, the rod will not be visible to the crewman, the panel hole will be open, and a loss of OWS atmosphere through the rod access hole will be evident (flow of OWS atmosphere will probably cause an audible sound as it escapes). References 15, 19, 21, 22, and 25.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 33 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.3 Specify the P_{f_t} for the extension rod handle.		0.1		IIIa	The extension rod/carrying handle is stowed on a mounting bracket that is fastened to the canister shell. The extension rod/carrying handle is used to grasp the end of each extension rod and aids in the connection and extension of the rods. The extension rod/carrying handle is used for maneuvering the photometer canister from its storage container to either SAL mounting flange while operating in a zero g environment. The P_f for the extension rod handle is considered small. If the handle assembly should fail, the following situations could occur: • Mechanical --If the plunger tension spring mechanism that loads the rod latches were to break, the latch detents could not engage and hold the aft extension rod threaded head section. --If the extension rod handle turn pin were broken, the extension sections could not be assembled by using the handle assembly. There would be no way for the turn pin to engage the slot on the rod threaded head section. • Operability --There are alternative operational procedures that the crewman would use to work around a failed or malfunctioned extension rod/carrying handle, but the mission timeline would probably be significantly affected. Some photometer program scans might be rescheduled or eliminated because of excessive extension rod assembly or disassembly time. The crew member should determine the malfunction or failure of the extension rod handle: • The extension rod handle can be disengaged from an extension rod end or its storage position without actuating the plunger. • The extension rod, once engaged into the handle assembly, can be rotated separately from the handle. If the extension rod on the tube is held securely and the inner attaching rod does not turn when the rod handle is rotated, the handle turn pin is failed. The extension rods cannot be assembled for photometer deployment, or the rods cannot be disengaged during photometer retraction. References 15 through 18, and 22.
3.5.1.1.4 Specify the P_{f_t} for the slewing handle.		0.1		IIIa	The slewing handle is stowed on the relay driver assembly. The handle, when used, is attached to the end of extension rod C by aligning the four pins in the handle with the holes in the extension rod, and releasing two spring latches on the handle. The handle is turned until the mechanical stop is encountered. This means that a tension load has been applied to the UXM and extension rods. The P_f for the slewing handle is considered small. If the slewing handle should fail, the following situations could occur:

MSFC - One-Time Form 22 (July 197-)

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 34 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.4 (Concluded)					• Mechanical --If the index pins on the slewing handle are bent out of alignment, the handle cannot be engaged on the C extension rod slot end, and the preload cannot be applied. --If the spring-loaded retention mechanism breaks, the index pins may disengage from the C rod when preload is applied. • Communications and Data --If the extension rods cannot be preloaded when deploying the photometer from the solar SAL, the scan programs are lost, but the system monitor programs can still be performed. The S-149 experiment cannot be operated if the above deployment equipment is not preloaded. The PCTVS cannot scan for the same conditions as mentioned in the mechanical interface. The inability to preload the seven extension rods constitutes a malfunction that could lead to the ejection of the photometer, if they cannot be retracted. • Support --The S-149 experiment cannot be operated from the solar SAL until a preload is applied to the deployment assembly (rods, UXM, and mast support tube). --The PCTVS cannot be operated (scan) from the solar SAL until a preload is applied to the deployment assembly. The following indications can be used to determine the failure of the slewing handle: • Visual inspection of the C rod and the slewing handle index pins by the crewman can be used to ascertain proper alignment and engagement on the rod shaft. • The crewman can remove the slewing handle from the rod without releasing the spring-loaded retention mechanism. • Approximately 37 cw turns of the slewing handle is required to apply the proper resistance preload to the extension rods. If a significantly greater number of turns has not applied a preload, either the slewing handle is not properly engaged into the C rod, or the inner rod attaching assemblies are not fully engaged. The crew member should investigate the malfunction before proceeding. References 15 through 18, and 22.
3.5.1.1.5 Describe the tube plug.				N/A	The tube plug has provisions for stowage on the same mounting bracket as the slewing handle. Should any one of the extension rods be inadvertently pushed through the O-ring seal housing, allowing OWS pressure to escape, the tube plug is removed from its stowage bracket and inserted into the mechanical control panel extension rod hole for sealing purposes. If overextension occurs, the crewman may be able to retrieve the deployed rod with the succeeding rod, if the rod index pins can be aligned and the stem end threads engaged. This would preclude ejection of the photometer system. If the overextended rod cannot be recaptured, the photometer system will be ejected. References 15 through 18.
3.5.1.1.6 Specify the P_{f_n} and P_{f_t} for the ejection rod.		$P_{f_t} = 0.07$		IIIa	The ejection rod provides the capability to eject the extension rod, UXM, orientation mechanism, and the photometer head into space in the event of a crew emergency or an unrecoverable equipment failure. If the photometer head cannot be retracted into the canister shell so that the SAL door can be closed, it will be ejected. An internal spring-loaded mechanism placed under compression is

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 35 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.6 (Continued)		$P_{f_n} = 0.01$ $P_{f_n} = 0.06$			positioned about 5 in. from the front end of the rod. To eject the photometer head requires the attachment of the ejection rod to the mast support tube adapter. First, the slewing handle is removed from extension rod C. The rod latch is opened and locked. The ejection rod is then partially threaded onto the mast support tube adapter. Next, the ejection rod LATCH lever is pulled outward, pivoted from left-to-right detent, and released. The threading of the ejection rod to the adapter is completed. The ejection rod may be pushed outboard until the rod's knurled knob is seated against the teflon adapter ring on the mechanical control panel. The extension rod latch is released to the closed position. The knurled knob is held while the small barber pole (bp) eject knob is rotated ccw to release a captive spring from compression. The front section of the ejection rod, the extension rods, UXM, orientation mechanism, and photometer head are propelled into space. When the ejection rod is fully deployed (before releasing the captive spring), the UXM mast support tube assembly and electrical connectors are extended beyond the OWS micrometeorite shield. This precludes hardware interference with the OWS when the unit is ejected. The P_f for the ejection rod is considered remote. If the rod assembly should fail, the following effects could occur: • Mechanical --The photometer head and other deployable hardware cannot be ejected if the eject LATCH lever is detented to the left and the mast support tube adapter moved outboard away from the mechanical control panel. The ejection rod tube cannot be threaded to the mast support tube adapter. --If the ejection rod prematurally loses the captive spring compression load, caused by either a fracture or backout of the small bp eject knob rod shaft, the photometer head cannot be ejected. --Refer to functional item 3.5.1.1.1. • Support --The S-149 experiment and PCTVS could not be ejected, if it were necessary to do so, if the situations occurred as mentioned in the mechanical interface. • Crew Safety --The bp eject knob shaft must never be disengaged from the ejection rod unless it is mounted in the mechanical control panel and deployed its maximum length. If the captive spring is prematurely released, the crewmen could be injured or the equipment damaged. The following indications can be used to determine the failure of the ejection rod: • The SAL doors cannot be closed after an ejection sequence. The SAL cannot be repressurized • Visual verification of photometer ejection from the -Z SAL can be accomplished by looking through the OWS wardroom window. It may be possible to visually verify that the photometer is ejected from the +Z SAL by looking through the command pilot's rendezvous window when in the CSM. When deploying the ejection tube for photometer ejection, the head assembly or orientation mechanism should be in the rendezvous window FOV. The limb of the OWS and some ATM truss assembly will occlude the extension rods.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 36 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.6 (Concluded)					• If the ejection rod is prematurely released, damage to the equipment can be visually observed or injury may occur to a crew member. • The astronaut will be unable to turn the bp eject knob ccw when the ejection rod is configured for a release mode. • The ejection rod cannot be threaded onto the mast support tube adapter by the crew member. References 15 through 18, 22, and 26.
3.5.1.1.8 Specify the P_{f_t} for the canister/ SAL seals.		0.05		IIIa	The canister assembly is designed to provide a structural flange with two molded O-ring seals that can be attached to either SAL experiment flange interface. The flange/seal arrangement is the interface between the canister and the SAL. The SAL latching mechanism receives the canister flange, secures it by forcing the seals against the mating surfaces, and seals against OWS atmosphere leakage. The leak rate for the seals should not exceed 5.9×10^{-2} STD cc/sec gaseous oxygen at 5 psid when the temperature is 70 ±5 °F. The P_f for the canister/SAL head is considered remote. If the seals should fail, they could have the following effects: • Mechanical --Excessive leakage of the OWS atmosphere through the SAL could result in the termination of the experiment. This situation would probably be caused by seal failure. • Support --If excessive leakage of the OWS atmosphere through the canister/SAL interface occurs, Experiment S-149 and the PCTVS may be discontinued. The following indication can be used to determine the failure of the canister/SAL seals: • An audible hissing sound at the canister flange and SAL interface may be detected by the crew member. References 15, 18, 19, 21, 22, 23, 24, 27, 28, 29 and 30.
3.5.1.1.11 Specify the P_{f_t} for the tripod interface.		0.09		N/A	A tripod assembly is used to inhibit the movement of the canister assembly when the photometer system is to be deployed from an SAL. The tripod is launched assembled and attached to the OWS experiment work area floor near SAL 2. During OWS activation the crewman will remove the tripod from the OWS floor and stow it in the vicinity of the ventilation control system duct number 3, stowage locker F553, and experiment S-183 stowage location F596. Tripod breakdown stowage is also provided at F568/F569. The tripod is attached to the OWS floor using hand screws. Each hand screw is tethered to a leg of the tripod. A threaded spaced is also attached to the hand screw. The spacer is reversed and rethreaded onto the hand screw when installing the tripod (a gap will be visible between the spacer and a reliefed section of the hand screw). A set of calfax fasteners on the back end of the canister assembly is threaded into a yoke that becomes attached to the bottom of the canister. The yoke is interfaced to a tripod support post when the canister is mounted to the SAL.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 37 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.1.11 (Concluded)					The tripod support post/yoke interface does not actually support the canister, but rather inhibits pitchdown load movement, prohibits yaw load movement, and allows pitchup load movement. A stop ring is located on the tripod support post and is adjusted to allow the canister a 78 lb pitchdown load before the yoke contacts the stop. The canister is not in positive contact with the tripod. The P_f for the tripod interface is considered remote. If the canister calfax fasteners cannot be attached to the yoke, the following situations could occur: • Mechanical --The yoke, if not attached to the canister, cannot bottom out against the tripod stop ring and preclude possible structural damage to the SAL/OWS wall interface. --If the tripod cannot be assembled, the canister/yoke interface arrangement is lost. • Crew Safety --Refer to functional item 3.5.1.1. • Operability --Refer to functional item 3.5.1.1. The crewman accomplishing the assembly tasks can detect the failure of the tripod interface: • The yoke cannot be threaded to the calfax fasteners. • The tripod fails after assembly, or it cannot be assembled. • The tripod stop ring cannot be adjusted for proper clearance (approximately 3/16 in. between the stop ring and the canister/yoke arrangement). *References* 15, 18, 22, 31, and 32.
3.5.1.2 Specify the P_{f_t} for the canister cover plate.		0.05		IIIa	The canister cover plate attaches to the front end of the canister to seal the retracted UXM and photometer head. The internal canister volume is pressurized to 5 psia with dry nitrogen for Skylab launch. A Seaton-Wilson valve is provided to allow evacuation and purging of the canister to maintain cleanliness. The P_f for the cover plate is considered remote. If the cover plate cannot be removed from the canister assembly, the following problems could occur: • Mechanical --The canister cannot be interfaced to the SAL and the photometer cannot be deployed. The T-027/S-073 experiment will be lost. • Support --The UXM, orientation mechanism, other associated deployment equipment used to support the S-149 experiment, and PCTVS cannot be operated. The S-149 experiment and PCTVS will be lost.

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 38 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.2 (Concluded)					The following indication can be observed by the astronaut to determine the failure of the cover plate: • The cover plate slide handle fails to deploy and/or the latching mechanism fails to release. References 15 through 19, 22 and 33.
3.5.1.3.1 Describe the mechanical control panel. Specify the P_{f_t} as a function of the panel's critical operating components.		0.16		IIIa	The mechanical control panel is attached to the relay driver unit. It contains provisions either for extending the UXM or as a contingency for ejecting the UXM. It also contains O-ring seals for OWS pressure integrity in all fixed positions of extension and retraction. References 15, 17, 18, and 22.
3.5.1.3.1.1 Specify the P_{f_t} for the rod lock and latch assembly.		0.05		IIIa	A sliding rod latch is located immediately below the extension rod hole and locks the UXM in either the two or seven rod extended or fully retracted positions. The spring-loaded latch is depressed to allow passage of the extension rods, and relatches at the two and seven rod extension or the fully retracted positions. The P_f for the rod lock and latch assembly is considered remote. If the rod latching mechanism should fail, the following effects could occur: • Mechanical --If the rod latch failed to release from the UXM mast support tube groove or extension rod deployment/retraction grooves, the photometer head cannot be deployed. --If the rod latch failed to engage the UXM mast support tube groove when fully retracted, the mast support tube assembly could inadvertently move into the canister and become lost. The extension rods could be properly assembled for photometer head deployment. --If the UXM were deployed and the rod latch failed to open, the ejection rod could not be fully engaged and deployed for equipment ejection. • Support --Experiment S-149 and the PCTVS will be lost if the UXM and orientation mechanism cannot be properly deployed for experiment or scan operations. The S-149 experiment is operated from the +Z SAL (7 rod deployment) and the -Z SAL (2 rod deployment), while the PCTVS is operated from the +Z SAL (7 rod deployment). The following indications can be used to determine the failure of the rod lock and latch assembly: • The crewman could not move the slide latch to either a lock open or to a groove close position. • The attaching spring to the slide latch is either fouled or broken and can be visually observed. • The pivot lock fails to either release or hold the slide latch when the latch is positioned to close or open. The crewman can determine the malfunction. References 15, 18, 19, 22, 34, and 35.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 39 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.1.2 Specify the P_{f_t} for the rod eject lever.		0.04		IIIa	The eject lever is provided for contingency operations which require the capability to eject the hardware internal to the canister in the event of a malfunction that would not allow retraction of the photometer head. Clockwise rotation of the lever unlatches detents to allow attachment and extension of the ejection rod. The lever knob is detented at both ends of travel and must be lifted for lever rotation. The P_f for the rod eject latch is considered remote. If the latch should fail to release for equipment ejection, the following situations could occur: • Mechanical --The ejection rod cannot be deployed to accomplish UXM equipment ejection. • Electrical --The power and instrumentation connectors that attach at the canister/UXM mast support tube interface cannot be moved forward to accomplish plug and receptacle separation. • Support --Experiment S-149 and the PCTVS could not be ejected if the need to do so arose. Experiment S-149 and the PCTVS use the same T-027/S-073 ejection system. The following indications can be used to determine the failure of the rod eject latch: • The eject lever cannot be pivoted and detented from left-to-right by the astronaut. • The UXM mast support tube adapter retaining latches cannot be disengaged. The adapter will not move into the canister assembly when deployed forward. The crewman can observe the movement of the adapter and latches. References 15, 18, 19, and 22.
3.5.1.3.1.3 Specify the P_{f_t} for the tube brake.		0.07		IIIa	A tube brake is used to provide a restraining force against the rods during extension and retraction so as to preclude inadvertent loss of rod through the access hole before the UXM is fully extended or retracted. The tube brake secures a throw-away plug, which is attached to the UXM mast support tube during launch. The plug is removed and disposed of when photometer deployment procedures are implemented. When the tube brake is not in use, it is detented out-of-the-way. The P_f for the tube brake is considered remote. If the tube brake should fail during extension rod deployment or retraction, it could have the following consequences: • Mechanical --The tube brake could not restrain the extension rods. The A and B extension rods could inadvertently slip through the rod access hole during deployment.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 40 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.1.3 (Concluded)					--If the extension rods are lost and the UXM not fully deployed and preloaded, the likelihood of a successful UXM ejection becomes significantly diminished. The UXM could become fouled with the canister, and, if ejected, interfere or damage some other OA module. • Support --Refer to functional item 3.5.1.3.1.2. • Operability --The crew member would be required to change the extension rod deployment and retraction operating procedures. Indication of the tube brake failure can be detected by the crewman while performing extension rod deployment or retraction: • The tube brake hand fastener will not attach the rod clamping segments together. • The extension rods move when the tube brake is enclosed about the rods and adjusted for full restraint. References 15 and 18.
3.5.1.3.2 Describe the common control panel. Specify the P_{ft} as a function of the panel's electrical control and display capability.		0.05		IIIa	The common control panel has the purpose of controlling power to the photometer head, orientation mechanism, and azimuth (shaft) and elevation (trunnion) readout. The common control panel has provisions for cable connections power ON-OFF switch, shaft and trunnion control switches, and position readouts. References 15, 17, 18, 36, and 37.
3.5.1.3.2.1.1 Describe the power supply.				IIIa	Power is obtained from the OWS 28 Vdc power distribution system at the SAL power outlet (panel 518 at the +Z SAL and panel 544 at the -Z SAL) and routed to the power supply assembly located within the common control panel. The power supply provides the following outputs: • 5.1 ± 3 percent Vdc logic supply • +13.2 ± 5 percent Vdc electronic supply • -13.2 ± 5 percent Vdc electronic supply • +28.5 ± 5 percent Vdc supply • 29.5 ± 10 percent Vdc supply • +31.0 ± 10 percent Vdc supply • 13 ± 15 percent Vdc supply

MSFC - One-Time Form 22 (July 197-)

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 41 of 81)

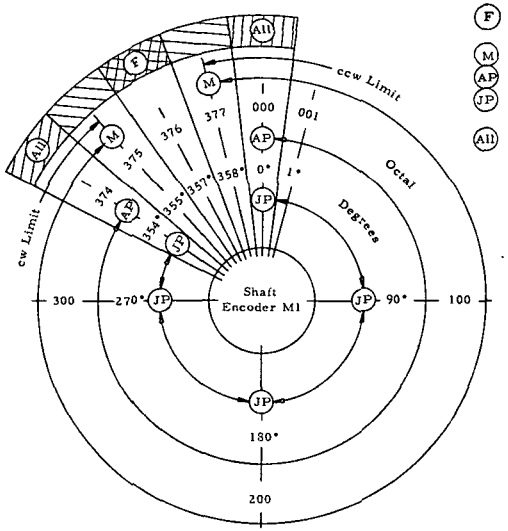
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.1 (Concluded)					• 115 Vac rms ±10 percent, 400 Hz ±10 percent (square wave) • 30 Vac rms ±10 percent, 400 Hz ±10 percent (square wave) • 28 Vdc filtered spacecraft power. References 15, 18, 37, 38, and 39.
3.5.1.3.2.1.1.1 Specify the P_{f_t} for the power switch (S1).		0.01		IIIa	The power switch (S1) applies power to the photometer system. Switch S1 is a two pole, double throw, hermetically sealed toggle switch that maintains a circuit at either position. The P_f for S1 is considered remote. If S1 should fail, the following effects could occur: • Electrical --If S1 fails open, power cannot be applied to the relay and driver assembly to drive the orientation mechanism and photometer head electrical subsystems. --If S1 fails closed in the POWER ON condition, the power cannot be cut off. The appropriate cb at panel no. 617 would have to be opened to cut off power to the experiment. • Communications and Data --If S1 fails open, no telemetry or DAC film will be acquired. The experiment will be lost. • Support --If S1 fails open, Experiment S-149 cannot be commanded open/close by the astronaut in case of ground controlled deployment malfunction of telemetry. The PCTVS cannot be operated. • Operability --The crewman can acquire 28 Vdc to the photometer system power supply through the manual control panel EXPERIMENT SELECT sw (S11), S-149 sw (S12), and requesting ground telemetry command signals S378 or S250 to be executed ON. The S11 sw must be in the S-149 position and the S12 sw must be positioned to CMD. These conditions permit 28 Vdc to be delivered to the experiment power supply. The photometer polarizer circuit will be disabled until telemetry signal S380 or S256 is commanded ON from the ground. The S380 or S256 command signal latches circuitry that permits the polarizer wheel to be driven. Indication of failure is by crewman observation that all control panel indicator readout lights will not illuminate (see readouts DS-1 through DS-5) when S1 is switched to the POWER ON position. References 15, 22, 36, 37, and 40.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 42 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.2 Describe the power and instrumentation receptacles (J6 and J7).					The SAL power cable (stowed in the photometer storage container F591) is connected from the common control panel at receptacle J6, to OWS panel 518/544, and makes power available to the photometer system from OWS buses 1 and 2. The SAL instrumentation cable (stowed in the photometer storage container F591) is connected from the common control panel at receptacle J7 to OWS panel 518/544, and provides a path for photometer data to the AM telemetry systems. The common-to-manual control panel cable is routed through the common control panel at J8 and connected to the manual control panel at J9. The J8 panel interface is a feed through and cannot be disconnected. References 15, 18, 36, 37, 38, and 41.
3.5.1.3.2.1.3.1 Specify the P_{ft} for the shaft switch (S2).		0.01		IIIa	The shaft switch (S2) is used to manually orient the photometer head in azimuth (refer to functional item 3.5.1.4.3.2). Switch S2 is a single pole, three position, hermetically sealed toggle switch, that maintains a circuit at all positions. S2, in the INCR position, rotates the head in an increasing angular direction; S2, in the DECR position, rotates the head in a decreasing angular direction; the center position is OFF. With the automatic programmer connected, S2 is used to manually set the mode initialization conditions of azimuth. With the shorting plug connected in place of the automatic programmer (at the manual control panel), all pointing is done manually. With the shorting plug installed, the following automatic stops are provided: Octal — Degrees 000 — 0.000 100 — 90.000 200 — 180.000 300 — 270.000 374 — 354.375 To move off these points, within the limits of travel, requires momentary placement of the S2 to the center position and then to the direction desired. With the automatic programmer connected, stops are provided at octals 377 (358.594°) and 374:

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 43 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.3.1 (Concluded)					

(F) Missed octal 376 (cw) or octal 000 (ccw) by 1 bit, or failed.
(M) Manual Operation
(AP) Automatic Programmer Operation
(JP) Jumper Plug Operation (stops at octals 000, 100, 200, 300, and 374)
(All) Shaft Nominal Operations Using (M) (AP) and (JP).

Shaft movement (azimuth or rotation) is normal to the OA Z axis.

The P_f for S2 is considered remote. If S2 should fail, the following indications could occur:

- Electrical
  - --If S2 fails closed in either INCR or DECR position and the circuit contact cannot be broken, the shaft motor will drive until the mecahnical stop is reached (shaft logic circuit is set up for reverse), and then automatically shut off. If S2 cannot be moved to the opposite drive function, the drive motor cannot be returned to the original shaft position.
  - --If S2 can be commanded to the opposite drive function, the motor will be driven in the selected function, stopped if desired, but cannot be commanded drive in the original failed position. The logic gates cannot receive a signal to change the gate position.

MSFC - One-Time Form 22 (July 19--)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 44 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.3.1 (Continued)					--If S2 fails open in either INCR or DECR position, the shaft motor cannot be operated in the failed position but can be operated in the unfailed position. • Pointing and Control --Presetting the shaft position for automatic programmer operation scans will be lost. Program scans that require the shaft to be initialized at some setting other than octal 040 cannot be set. • Operability --Initial shaft settings can be set up using an automatic programmer contingency operation. By selecting the proper mode, repetitions, shaft limit setting on the automatic programmer and operating the program start switch on the manual control panel, it is possible to preset an initialize shaft setting. Indication of S2 failure can be determined by the crewman when operating the S2 to either an INCR or DECR position. No change in octal readout will be noted when commanded to a different shaft position. References 15, 18, 22, 36, 37, 38, and 41.
3.5.1.3.2.1.3.2 Specify the P_{f_t} for the shaft readout (DS-1).		0.01		IIIa	The shaft readout (DS-1) is an electro-luminescent indicator of the azimuth angular position in octal. The P_f for DS-1 is considered remote. If DS-1 should fail, the following effects would occur: • Electrical --If the indicator fails to illuminate, the shaft position cannot be accurately determined by the crew. --If an indicator element is lost it will not display a numerical readout, but the indicator can be interpreted by referring to the remaining octal readouts and knowing that the shaft drive rate is 4 deg/sec. • Pointing and Control --Refer to electrical interface above. • Operability --The crewman can acquire the shaft setting from the ground personnel. A failure of DS-1 can be determined by the astronaut:

MSFC - One-Time Form 22 (July 197-)

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 45 of 81)

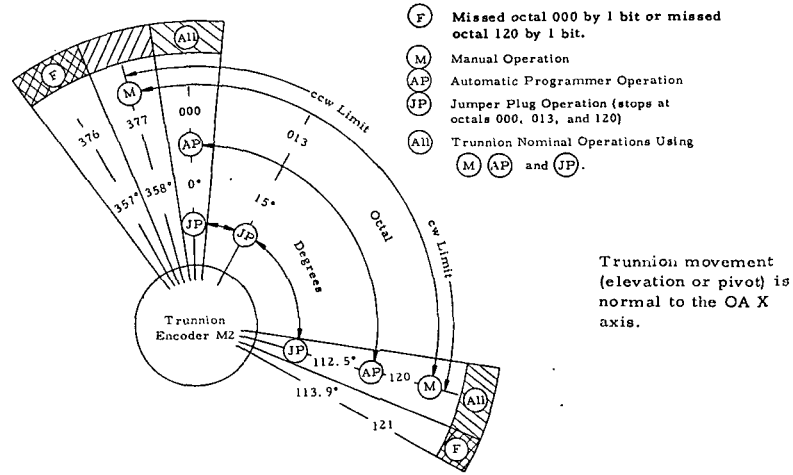
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.3.2. (Concluded)					• Any change in shaft position should be registered on DS-1. If the readout is not illuminated, the octal numbers cannot register. • The loss of an indicator element will permit interpretation of the display. • The ground personnel can interrogate the shaft position information telemetry data (see measurement number G7025T027). References 15, 22, 36, 37, 38, and 41.
3.5.1.3.2.1.4.1 Specify the Pf_t for the trunnion switch (S3).		0.01		IIIa	The trunnion switch (S3) is used to manually orient the photometer head in elevation (refer to functional item 3.5.1.4.3.1). Switch S3 is the same type as S2. When the shorting plug is installed, the automatic stops are: Octal: 000, 013, 120 — Degrees: 0.000, 15.469, 112.500 With the automatic programmer connected, stops are provided at octals 000 and 120:  Trunnion movement (elevation or pivot) is normal to the OA X axis.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 46 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.2.1.4.1 (Concluded)					The P_f for S3 is considered remote. If S3 should fail, the failure indications and cues would be similar to S2 except that the trunnion logic, drive motor, and octal display are affected (see functional item 3.5.1.3.2.1.3.1). References 15, 18, 22, 36, 37, 38, and 41.
3.5.1.3.2.1.4.2 Specify the P_{f_t} for the trunnion readout (DS-2).		0.01		IIIa	The trunnion readout (DS-2) is an electro-luminescent indicator of the elevation angular position in octal. The P_{f_t} for DS-2 is considered remote. If DS-2 should fail, the failure indications and cues would be the same as for DS-1 (see functional item 3.5.1.3.2.1.3.2). The trunnion information telemetry measurement is G7016T027. References 15, 18, 22, 36, 37, 38, and 41.
3.5.1.3.3 Describe the manual control panel. Specify the P_{f_t} as a function of the panel's electrical control and display capability.		0.17		IIIa	The manual control panel controls and displays the following photometer head functions: • Experiment select • Filter wheel (FW) • FOV • DAC shutter • PMT --Shutter and cap position, and intensity. • Power and instrumentation panel interface The manual control panel assembly is located adjacent to the common control panel. The removable assembly is attached by inserting the locating pins at the bottom of the panel into the receiving holes of the bracket provided on the canister. The manual control panel is secured by means of two Calfax fasteners located on top of the panel. The manual control panel contains much of the control and circuit logic peculiar to the photometer operation. References 15, 17, 18, 37, 41, and 42.
3.5.1.3.3.1 Specify the P_{f_t} for the experiment select switch (S11).		0.01		IIIa	The experiment select switch (S11) is used to enable the polarizer motor circuit when positioned to T027/S073. In the S149 position, the S-149 motor drive circuit is enabled. Switch S11 is a two pole, double throw, hermetically sealed toggle switch that maintains a circuit at either position.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 45 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.1 (Concluded)					The P_f for S11 is considered remote. If S11 should fail, the following consequences would occur: • Electrical --If S11 fails open, there is no effect on T-027/S-073, but a power return path cannot be established for Experiment S-149. --If S11 fails closed at the T-027/S-073 position, there is no effect on the T-027/S-073 experiment, but Experiment S-149 loses the power return path. --If S11 fails closed at the S149 position, there is no effect for the S-149 experiment, but the polarizer motor circuit for the T-027/S-073 experiment is grounded (see Operability below). • Communications and Data --If the polarizer wheel circuit is disabled, the polarizer wheel encoder (M1) cannot operate, and the polarizer wheel synchronization telemetry signal is lost. --If the S-149 MD/CSU circuit is disabled, the S-149 cassette position telemetry measurement signals and manual control panel visual readouts cannot function when the experiment is commanded to operate. • Operability --See functional item 3.5.1.3.2.1.1.1. Indication of switch S11 failure can be observed by the crewman, and/or the ground personnel when the experiment is operated. • When the T-027/S-073 experiment is operated, the ground personnel should receive the K7107T027 polarizer wheel synchronization telemetry signal. References 15, 22, 37, 38, 41, and 4 .

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 46 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.2.1 Specify the Pf_t for the FW step switch (S6).		0.01		IIIa	The FW step switch (S6) controls the position change for FW's A and B located in the center housing of the photometer head. Switch S6 is a single pole, three position, hermetically sealed toggle switch that is spring returned to the center (AUTO) position, and provides a momentary circuit at MAN-A and MAN-B switch positions. Movement of S6 to MAN-A steps FW A to the next position. Movement of S6 to MAN-B steps FW B to the next position. The Pf for S6 is considered remote. If S6 should fail, the following effects would occur: • Electrical --If S6 fails open, power cannot be applied to the logic and relay driver circuits. The FW stepping motors (B1 and B2) cannot be manually or automatically moved to the next position. --If S6 fails closed in a manual position, FW A or FW B will continue to step until power is interrupted at the manual control panel. --If S6 fails closed in the AUTO position, the FW cannot be positioned manually. There is no effect on the automatic programmer control circuit, and both FW's can be sequenced when commanded to do so. • Operability --If S6 fails, the FW cannot be electrically synchronized (see functional item 3.5.1.3.3.2.3). An S6 switch failure indication can be discerned by the crewman when he observes DS-3 registering FW position changes. References 15, 22, 37, 38, 41 and 42.
3.5.1.3.3.2.2 Specify the Pf_t for the FW auto switch (S7).		0.01		IIIa	The FW auto switch (S7) permits the FW's to sequence step through the filter positions. Switch S7 is a single pole, three position, hermetically sealed toggle switch that can maintain a circuit in any of the three positions. With the shorting plug installed and S7 in position FW A, momentarily initiating PORGRAM START will cause the sequencing through of the five filters in FW A. Placing S7 in positions A&B and initiating PROGRAM START will cause the sequencing through the five filters in FW A and the five filters in FW B. In position B no function occurs. With the automatic programmer installed, the same is true as above except that when S7 is positioned to FW B the five filters in FW B are sequenced through. The Pf for S7 is considered remote. If S7 should fail, the following situations would occur: • Electrical --If S7 fails open, power cannot be applied to the logic relay driver circuit, and the automatic programmer sequence circuit to control and operate B1 and B2 that turn the FW's. The FW cannot be sequenced through the selected S7 switch position.

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 47 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.2.2 (Concluded)					--If S7 fails closed in any one of the three switch positions and the automatic programmer is used to control the FW's, a sequence of FW positions will be completed for the failed S7 switch position when the PROGRAM START switch is positioned to START. The other two S7 switch functions will be inoperative. --If S7 fails closed in the FW B position and the shorting plug is used to control the FW's, then FW A and FW A&B sequence capability is lost. The astronaut can detect the failure of the FW's to sequence by referring to DS-3: • An FW position should change every 12 sec. with 4 sec intervals between FW A and FW B when the automatic programmer is used. A 14 sec interval between FW A and FW B will be noted whenever the shorting plug is used to control FW sequence. • The ground personnel can determine if the FW's have sequenced properly by observing the change of state for the following telemetry measurements: FW A: K7270Z027 K7270T027; K7271Z027 K7271T027; K7272Z027 K7272T027 FW B: K7268Z027 K7268T027; K7269Z027 K7269T027; K7298Z027 K7298T027 References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.2.3 Specify the Pf_t for the FW A and B readout (DS-3).		0.01		IIIa	The FW A and B readout (DS-3) is an electro-luminescent indicator of the FW A and FW B filter positions. Each FW contains five filters and one open hole. An eight appearing on the readout indicates an out-of-sync condition between the readout circuitry and the FW position. This is likely to occur on power dropout or on initial power application, which resets the readout circuitry. To reacquire synchronization, S6 must be actuated until a zero appears on the readout. The Pf for DS-3 is considered remote. If DS-3 should fail, the following effects would occur: • Electrical --If the indicator fails to illuminate, FW A and FW B positions cannot be determined. --Refer to functional item 3.5.1.3.2.1.3.2. • Operability --The crewman cannot electrically synchronize the FW's using S6. • Support --If the DS-3 readout fails, the S-149 cassette opening/closing displays are lost.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 48 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.2.3 (Concluded)					The failure of DS-3 readout can be determined by the crewman when operating the photometer head: • If the readout is not illuminated, the FW A and FW B positions cannot be displayed. • The ground personnel can determine if FW A and FW B are synchronized by monitoring the change of state for those telemetry measurements found in functional items 3.5.1.3.3.2.2: References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.3.1 Specify the P_{f_t} for the FOV readout.		0.01		IIIa	The FOV readout (DS-3) is an electro-luminescent indicator of the FOV wheel position. There are six FOV wheel positions. The FOV positions are read on the right hand portion of the indicator while the FW positions are read on the left hand portion. Loss of synchronization and resynchronization procedure is the same as for FW readout. The P_f for the FOV readout is the same as the FW readout; therefore, the fail effects are similar, except that the FOV position indications are affected by the FOV step switch (S5). The failure of the FOV readout can be detected by the crewman when operating the photometer head: • If the readout is not illuminated, the FOV positions cannot be displayed. • Ground personnel can determine the position of the FOV wheel by analyzing the following telemetry measurements: K7275Z027 K7275T027 K7274Z027 K7274T027 K7273Z027 K7273T027 References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.3.2 Specify the P_{f_t} for the FOV step switch (S5).		0.01		IIIa	The FOV step switch S5 controls the position change for the FOV wheel located in the aft housing of the photometer head. Switch S5 is a single pole, two position, hermetrically sealed toggle switch. The switch's STEP position is a momentary contact to establish the stepping motor circuit, while the other position is spring actuated to brake the circuit contact. When circuit contact is made, the FOV stepping motor (B3) drives the FOV wheel to the next position. The P_f for S5 is considered remote. If S5 should fail, the following effects would occur:

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 49 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.3.2 (Concluded)					• Electrical --If S5 fails open/closed in the relaxed position, power cannot be applied to the logic and relay driver circuit. Motor B3 cannot drive the FOV wheel. --If S5 fails open/closed in the STEP position, the B3 will operationally step as commanded by the automatic programmer so long as the relaxed position of S5 works. • Operability --If S5 fails, the ability to select and maintain an FOV setting for a photometer scan measurement will be lost. The ability to electrically operate the FOV for synchronization purposes will be lost. Switch S5 failure can be determined by the astronaut as shown in functional item 3.5.1.3.3.2.1, except that the response is for the FOV as displayed on readout DS-3. References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.4.1 Specify the P_{f_t} for the camera shutter switch (S14).		0.01		IIIa	The camera shutter switch (S14) controls the position of the DAC located on the photometer head. Switch S14 is a single pole, two position, hermetically sealed toggle switch. The switch's OPEN/CLOSE position is a momentary contact to make circuit while the AUTO SEQ position is a maintained contact to make circuit. Momentarily placing the switch in the OPEN/CLOSE position will command the shutter to its alternate position; i.e., Open if closed or Closed if opened. The P_f for S14 is considered remote. If S14 should fail, the following effects would occur: • Electrical --If S14 fails open, power cannot be applied to the camera automatic sequence circuit. --If S14 fails open/closed in the OPEN/CLOSE position, the shutter cannot be cycled during DAC shutter synchronization procedure. --If S14 fails closed in the AUTO SEQ position, the DAC shutter cannot be synchronized. The manual DAC shutter oepn/close function is lost. A failure of S14 can be detected by the astronaut when synchronizing the camera to the photometer program modes: • The astronaut can monitor the camera shutter readout (DS-4) for a bp (shutter is closed) or blank (shutter is open) display. • Ground personnel can also monitor the camera's shutter position by evaluating telemetry measurement K7309T027. References 15, 22, 37, 38, 41, and 42.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 50 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.4.2 Specify the Pf_t for the camera sequence switch (S13).		0.01			The camera sequence switch (S13) is used to cycle the DAC shutter when operating the photometer head in a manual mode. Switch S13 is a single pole, two position, hermetrically sealed toggle switch. The START position is a momentary contact to make circuit. Switch S13 is spring returned to the open circuit position. Switch S13 is used only when the shorting plug is installed. Placing S13 in the SEQ START position starts a 100 sec camera shutter open, 1 sec closed, 1 sec open, then close sequence. To repeat this sequence the SEQ START switch must be reinitiated. The P_f for S13 is considered remote. If S13 should fail, the following consequences would occur: • Electrical --If S13 fails open/closed, power cannot be applied to the camera sequence circuit. The DAC shutter cannot be cycled when using the shorting plug. The S13 function becomes inoperative. The astronaut and ground personnel can determine S13 failure: • The crewman can detect the failure of S13 by monitoring the camera shutter readout (DS-4) position display when moving the S13 to the SEQ START position. • Ground personnel can monitor the camera's shutter position (refer to telemetry measurement K7309T027). References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.4.3 Specify the Pf_t for the camera shutter readout (DS-4).		0.01		IIIa	The camera shutter readout (DS-4) is an electro-luminescent indicator of the camera shutter position. A barber pole (≡) readout indicates a closed camera shutter. A blank readout indicates an open camera shutter. The readout and the shutter position may not be in synchronization on power dropout or initial power application. Therefore, following initial power application or power dropout, the CAMERA SHUTTER OPEN/CLOSE switch must be activated at least twice to be certain the shutter and readout are in synchronization. The P_f for DS-4 is considered remote. If DS-4 should fail, the following situations could occur: • Electrical --If the indicator fails to illuminate, the DAC shutter position cannot be determined. • Operability --The crewman cannot determine if the DAC shutter is synchronized, by using the PMT shutter switch (S8).

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 51 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.4.3 (Concluded)					The crewman can determine the failure of DS-4 readout when operating the photometer head: • If the readout is not illuminated, the DAC shutter position cannot be displayed. • The ground personnel can determine the DAC shutter position and synchronization by analyzing the change of state for telemetry measurement K7309T027. References 15, 22, 37, 38, 41, and 42.
3.5.1.3.3.5.1.1 Specify the P_{f_t} for the PMT shutter switch (S8).		0.01		IIIa	The PMT shutter switch (S8), opens and closes the PMT shutter when the photometer head is operated. Switch S8 is a single pole, three position, hermetrically sealed toggle switch. Momentary contact either opens the circuit or closes the shutter. The center position (AUTO) is normally closed. Placing S8 in the OPEN position opens the PMT shutter. Placing S8 in the CLOSE position closes the PMT shutter. In the AUTO position, shutter control is available from automatic programmer command. The P_f for S8 is considered remote. If S8 should fail, the following effects would occur: • Electrical --If S8 fails open in the SHUTTER OPEN position, power cannot be applied to the PMT logic shutter circuit. The PMT solenoid (L2) cannot open the shutter. The PMT manual shutter open capability and PMT measuring capability are lost. --If S8 fails closed in the SHUTTER OPEN position, the AUTO and manual CLOSE functions are still operable. --If S8 fails open in the AUTO position, the PMT shutter will remain open if opened, or remain close if closed. --If S8 fails closed in the AUTO position, the manual open/close switch capability is lost. --If S8 fails open in the SHUTTER CLOSE position, the manual capability to close the PMT shutter is lost. --If S8 fails closed in the SHUTTER CLOSE position, the capability to manually open the PMT shutter is lost. Indication of S8 failure can be visually detected by the astronaut when he monitors the PMT shutter readout (DS-4): • When the astronaut places S8 in the PMT SHUTTER OPEN or CLOSE position, the shutter should display the appropriate indication at DS-4. (bp indicates PMT shut closed and a blank indicates PMT shutter open). • The ground personnel can also determine PMT shutter position by monitoring telemetry measurement K7265Z7291 or K7265K7291. References 15, 22, 37, 38, 41, and 42.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 52 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.5.1.2 Specify the P_{f_t} for the PMT shutter readout (DS-4).		0.01		IIIa	The PMT shutter readout (DS-4) is shared with both the DAC shutter readout and the shutter cap readout. The PMT shutter readout indications for open and close are identical to that of the camera shutter. The PMT shutter requires no synchronization. The P_f for DS-4 is specified in functional item 3.5.1.3.3.4.3 and is identical to this functional item. The failure indications as specified for functional item 3.5.1.3.3.4.3 apply to the PMT shutter readout, except that the ground personnel should monitor telemetry measurement K7265Z7291 or K7265K7291. References 15, 22, 37, 41, and 42.
3.5.1.3.3.5.2.1 Specify the P_{f_t} for the PMT cap switch (S9).		0.01		IIIa	The PMT cap switch (S9) serves the same function as S8, except that it opens and closes a cap. The P_f for S9 is considered remote. If S9 should fail, the following problems would occur: • Electrical --If S9 fails open in the CAP OPEN position, power cannot be applied to the PMT logic cap circuit. The PMT linear solenoid (L1) cannot be pivoted open. Manual capability to OPEN the cap is lost. The AUTO function is affected. --If S9 fails closed in the CAP OPEN position, the cap cannot be manually or automatically closed. --If S9 fails open/closed in the AUTO position, there is no effect. --If S9 fails open in the CAP CLOSE position, manual capability to close the cap is lost, but the automatic capability to close the cap is affected. --If S9 fails closed when in the CAP CLOSE position, the cap cannot be manually or automatically opened. • Operability --If the S9 remote control function is lost, the crewman can retrieve the photometer head, disconnect the L1 linkage, wire open the cap, reextend the photometer head, and continue to operate under degraded conditions. The crewman can detect S9 failure by using the same cues at the DS-4 readout as when operating the cap switch manually. The ground personnel can determine PMT cap position by monitoring telemetry measurement K7264Z7293 or K7264K7293. References 15, 22, 37, 41, and 42.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 53 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.5.2.2 Specify the Pf_t for the PMT cap readout (DS-4).		0.01		IIIa	Refer to functional item 3.5.1.3.3.5.1.2. The ground personnel should monitor telemetry measurements K7264Z7293 or K7264K7293. References 15, 22, 37, 41, and 42.
3.5.1.3.3.5.3.1 Specify the Pf_t for the PMT gain switch (S10).		0.01		IIIa	The PMT gain switch (S10) is used to maintain the PMT output INTENSITY meter reading within the instrument's range for comprehensive data coverage. Switch S10 is a double pole, three position, hermetrically sealed toggle switch. All switch positions are fully maintained to make circuit contact. Low average intensity meter readings require an increase in gain switch position and, conversely, a high average reading requires a decrease in gain switch position. Each step changes the gain by a factor of approximately 10. The Pf for S10 is considered remote. If the switch should fail, the following situations would occur: • Electrical --If S10 fails closed in the HIGH/MED position, the gain intensity circuit is unaffected in the failed position, and a K7266T027 or K7267T027 telemetry signal will be recorded; but, the intensity meter readout (DS-5) may indicate differently when the switch is rotated to MED and LOW. --If S10 fails open in the HIGH/MED position, the gain intensity circuit is unaffected. no gain signal output for telemetry, and DS-5 will read low for the failed positions. --If S10 fails open/closed in the LOW position, the gain circuitry, telemetry, and readout are unaffected. • Communications and Data --Refer to comments made in the electrical interface. The crewman and ground personnel can determine S10 failure when selecting a switch position: • The astronaut can monitor DS-5 display to determine the relative indicator position when operating S10 to measure light intensity. • The ground personnel can monitor the change in PMT gain by referring to telemetry measurements K7266Z027 or K7266T027 (high gain), and K7267Z027 or K7267T027 (medium gain). References 15, 22, 37, 41, and 42.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 54 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.5.3.2 Specify the P_{f_t} for the PMT intensity meter readout (DS-5).		0.01		IIIa	The intensity meter readout (DS-5) is a 0 to 5 Vdc indicator that displays PMT voltage output to the telemetry system. DS-5 is used in conjunction with S10. The P_f for DS-5 is considered remote (see functional item 3.5.1.3.3.5.3.1). The crewman can detect a DS-5 failure if the dial indicator does not register when S10 is placed in the HIGH gain position, PMT shutter and cap open, and the photometer pointing at a high intensity light source. The PMT dark current calibration reference voltage is 0.5 Vdc. References 15, 22, 37, 41, and 42.
3.5.1.3.3.6 Describe the S149 command switch (S12).				IIIa	With Experiment S-149 installed and the experiment select switch (S11) in the S149 position, the positioning of S12 to the OPEN position will open the S149 detector panels. Movement to the CLOSE position will close the S149 detector panels. When placed in the CMD position the ground has control through telemetry to turn on power and to position the panels open or closed. References 15, 22, 37, 41, and 42.
3.5.1.3.3.7 Specify the P_{f_t} for the program start switch (S4).		0.02		IIIa	The program start switch (S4) initiates a scan mode using the automatic programmer. Switch S4 is a single pole, double throw, hermetrically sealed toggle switch. The PROGRAM START position is a momentary contact, and spring returns to open. There are seven different programmer modes. With the shorting plug installed, movement of the S4 to the START position initiates an internal filter change sequence. The P_f for S4 is considered remote. If S4 should fail, the following consequences are evident: • Mechanical --If the program switch fails, the photometer cannot be operated automatically. • Electrical --If S4 fails open/closed in the PROGRAM START position, the automatic programmer is lost. • Operability --The astronaut can operate the photometer system manually, but the mission flight timeline will be severely impacted. A significant time will be needed to conduct photometer scan measurements. Failure of S4 can be determined by the astronaut and ground personnel:

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 55 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.3.7 (Concluded)					• Upon program initiation, the astronaut can monitor the common, manual, and automatic control panels to determine if the displays change. Attention should first be focused to the automatic programmer light (PROGRAMMER ON); if the light is illuminated, the photometer is operating. • The ground personnel can determine the status of photometer operation by monitoring telemetry measurements: K7170Z027 M7074Z027 K7270Z027 or K7270T027 K7271Z027 or K7271T027 K7272Z027 or K7272T027 K7264Z7293 or K7264K7293 K7265Z7291 or K7265K7291 K7313Z7294 or K7313K7294 References 15, 22, 37, 41, and 42.
3.5.1.3.5.3.8 Describe the power and control cable receptacles (J9).					The common panel cable receptacle (J9) is located on the lower left-hand section of the manual control panel. When the photometer head is replaced with the PCTVS, the manual control panel assembly is disconnected, removed, and stowed in the F591 storage container. A PCTVS control panel is mounted on the canister in place of the manual control panel. The programmer cable receptacle (J10) is located on the lower right-hand section of the manual control panel. It is used to either connect the automatic programmer into the photometer circuitry when the programmer is used, or to connect the shorting plug to J10 as a contingency manual mode of operation should the automatic programmer fail. References 15, 18, 22, 37, 41, 42, 43, and 44.
3.5.1.3.3.9.1 Describe the shorting plug.					A shorting plug and two dust caps are stowed on the manual control panel. The shorting plug is connected to the manual control panel whenever the cable from the automatic programmer is not attached. In this configuration, the photometer can be operated either manually or automatically in a filter change A, A&B camera automatic sequence mode; or in a separate camera automatic sequence. References 15, 17, 18, and 41.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 56 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4 Describe the automatic programmer. Specify the P_{f_t} as a function of the programmer's electrical control and display capability.		0.19		IIIb	The automatic programmer is used to conduct photometer light intensity measurement scans within given boundaries, at selected time periods, for a number of repetitions. All these functions are programmable and accomplished automatically when the crewman commands the experiment to be operated. The automatic programmer is detachable from the canister assembly. References 15, 17, 18, 37, and 43 through 46.
3.5.1.3.4.1 Specify the P_f for the automatic programmer's control and display panel.		0.19		IIIb	The automatic programmer's control and display panel functions are: • Mode--the capability to select seven different photometer programs. • Reps--the capability to repeat any program 64 times. • Orbital Period Adjust--the capability to operate a photometer program over a range of orbital periods. • Trunnion Limits--the capability to scan the photometer head in elevation within a set of limits. • Shaft Limits--the capability to scan the photometer head in azimuth within a set of limits. • Programmer On--indicates when a program scan is being accomplished. • Camera Program Enable--enables the DAC. The mode, reps, orbital period adjust, and trunnion and shaft limit control and display functions are selectable and read out with push button, rotary switches (PBRS's). Pressing the increase button (INCR) mechanically steps the switch to the next higher number. Pressing the decrease button (DECR) steps the switch to the next lower number. In the center of each switch is an octal readout of the switch position. Each switch has eight positions--zero through seven, inclusively. The switch position is visually displayed on each switch. The reps, orbital period adjust, and trunnion and shaft limit functions are read in octal. The mode function is read as a digit. The programmer ON function is displayed by a lamp. The camera enable switch is controlled by a single pole, double throw, hermetrically sealed toggle switch. Both switch positions are maintained. The P_f for the control and display functions is considered remote. If a PBRS or toggle switch fails, the automatic programmer control capability for a photometer program scan is lost. Both the crewman and the ground personnel can detect failures to the automatic programmer's control and display:

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 57 of 81)

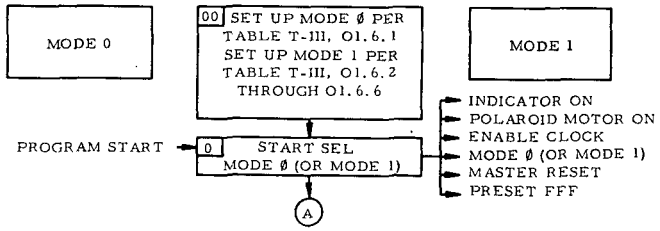
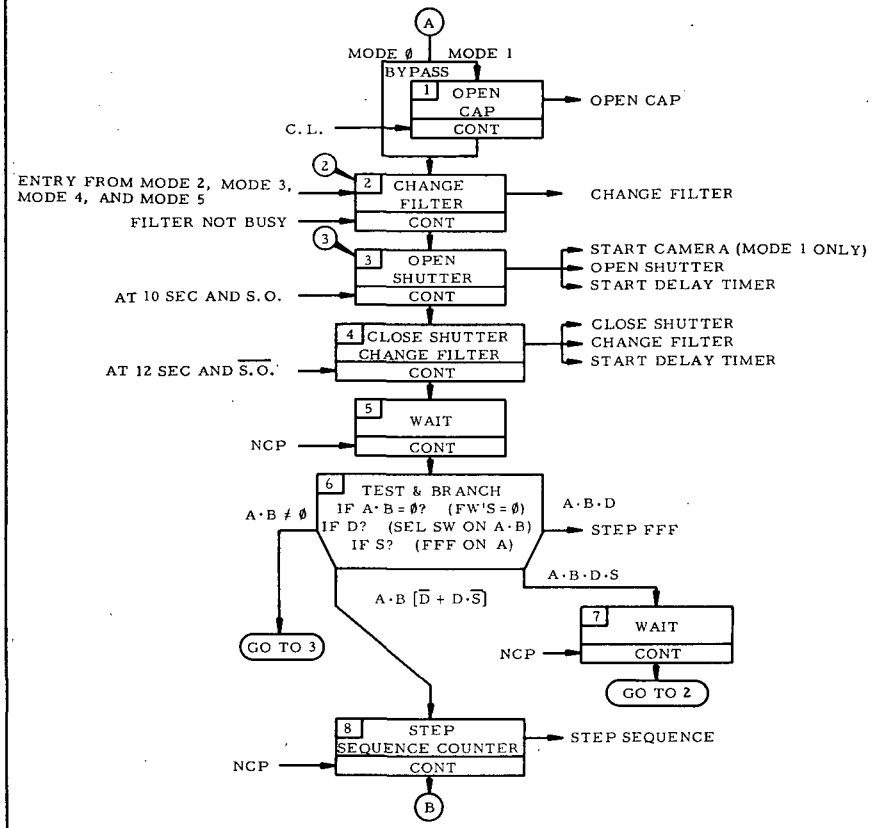
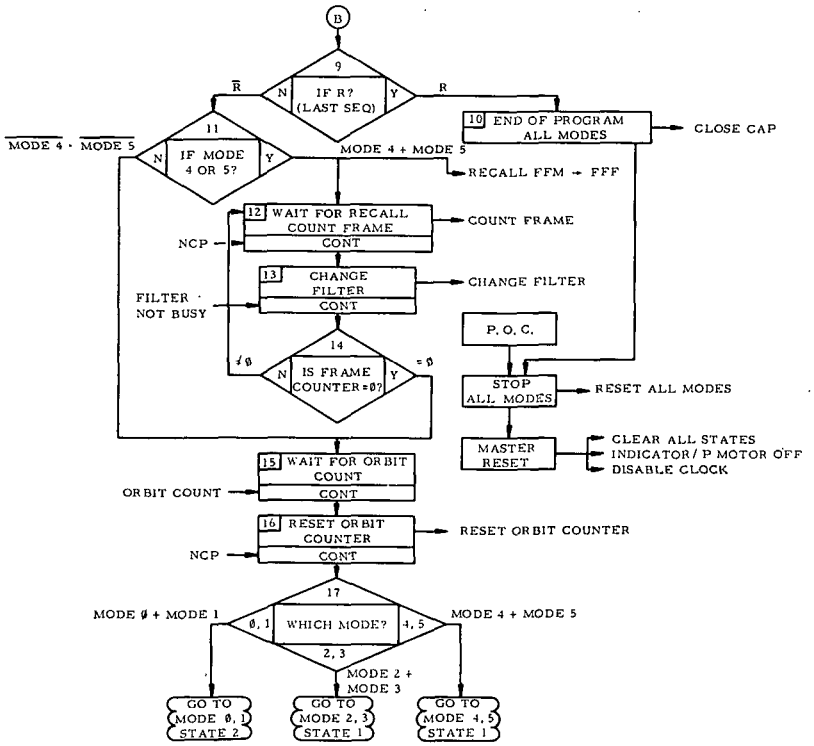
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1 (Concluded)					• The crewman can operate and monitor the control and display functions as he enters them on the panel. If the PBRS does not operate, the display will not operate. There is no display for the camera enable switch. • The ground crew can determine if the automatic programmer is functioning properly by monitoring the photometer performance telemetry data (Table T-II). References 15, 17, 18, 37, and 43 through 46.
3.5.1.3.4.1.1 Describe the mode control and display function.				N/A	The mode PBRS selects and displays one of seven photometer programs: Mode — Program 0 — Calibration 1 — Fixed Position 2 — Vertical Circle 3 — Almucantar Scan 4 — Limited Area Sky Mapping 5 — All Sky Mapping 6 — Stowage Position Return • Mode 0, Calibration The photometer PMT cap remains closed (placing the calibrating light source in the photometer system light path) and each of the 10 filters is sequenced into position for calibration (S7 must be in A and B). A Mode 0 programming format is shown below. • Mode 1, Fixed Position (no scans in trunnion or shaft) The photometer head is pointed manually to any position within the mechanical limits of shaft and trunnion. Depending on the FW selection (A, B, A and B), the program will collect data using either the 5 filters in FW A, the 5 filters in FW B, or the 10 filters in FW's A and B. The automatic programmer will command the DAC to take 1 frame/filter position during this sequence. A Mode 1 programming format is shown below. 

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 58 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					

S&E-ASTN-OT(6-71)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 59 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					

NOTE: CAMERA PROGRAM IS INHIBITED.

NOTE: CAMERA FRAME IS AUTOMATIC:

1. ONE CAMERA FRAME IS EXPOSED AT THE BEGINNING OF EACH FILTER FRAME.
2. PROGRAM IS INHIBITED.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 60 of 81)

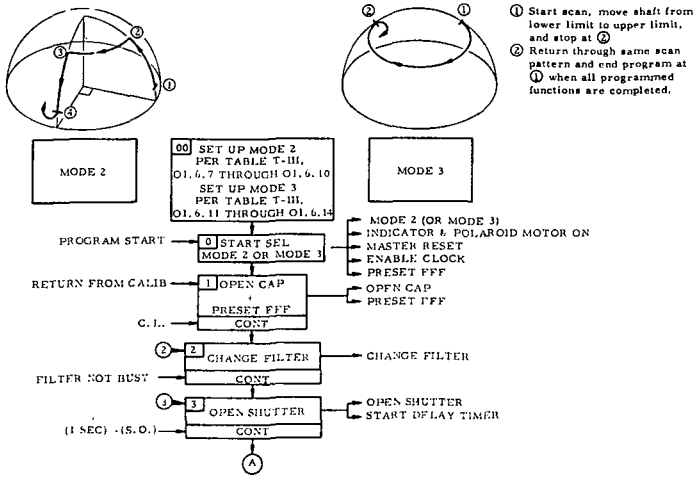
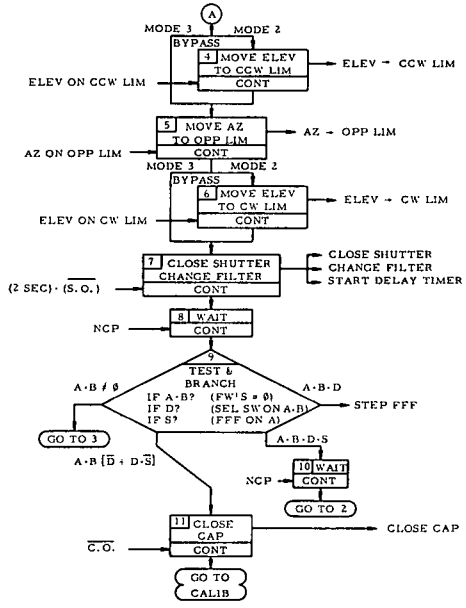
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					• Mode 2, Vertical Circle Scan (scans in trunnion at a fixed shaft) The shaft and trunnion limits are set as desired. Upon program initiation, trunnion moves from its upper limit to the trunnion lower limit, shaft remaining fixed at its lower limit. Next the shaft moves to its upper limit and remains fixed while the trunnion system moves back to its upper limit. At this time the shutter closes, the filter is changed, and the path is retracted back to the start. This is repeated until the selected FW's have been sequenced. The camera records one frame every 11.25° of trunnion scan. A Mode 2 programming format is depicted below. • Mode 3, Almucantar Scan (scans in shaft at fixed trunnion) Initiation of the automatic programmer causes the shaft to scan from the lower limit to the upper limit, perform a filter change, scan back, perform another filter change, and repeat until all filters have been sequenced through the selected FW's. The camera records one frame for every 45° of shaft scan. A Mode 3 programming format is depicted below. ① Start scan, move trunnion from upper limit to lower limit and stop at ② ② Move shaft to upper limit and stop at ③ ③ Move trunnion back to upper limit and stop at ④ ④ Return through same scan pattern and end program at ① when all programmed functions are completed. 

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 61 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					

NOTE: CAMERA FRAME IS AUTOMATIC:
1. EVERY 11.25° OF ELEV FOR MODE 2
2. PROGRAM IS INHIBITED
3. THE MODE 2 SCAN TRACE IS SUMMARIZED AS FOLLOWS:

NOTE: CAMERA FRAME IS AUTOMATIC:
1. EVERY 45° OF AZIMUTH FOR MODE 3
2. PROGRAM IS INHIBITED.
3. THE MODE 3 SCAN TRACE IS SUMMARIZED AS FOLLOWS:

- Mode 4, Limited Sky Mapping (scans in trunnion and shaft)
  A series of almucantar scans are performed and separated by incremental steps of approximately 2.8° in trunnion. This is done within the upper and lower limits set in shaft and trunnion. A full mapping is completed before a filter change. The camera records one frame for every 45° of shaft scan. A Mode 4 programming format is shown below.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 62 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					• Mode 5, All Sky Mapping (scans in trunnion and shaft) This mode is the same as mode 4 except that trunnion step increments are approximately 5.6° (4 bits). A Mode 5 programming format is depicted below.

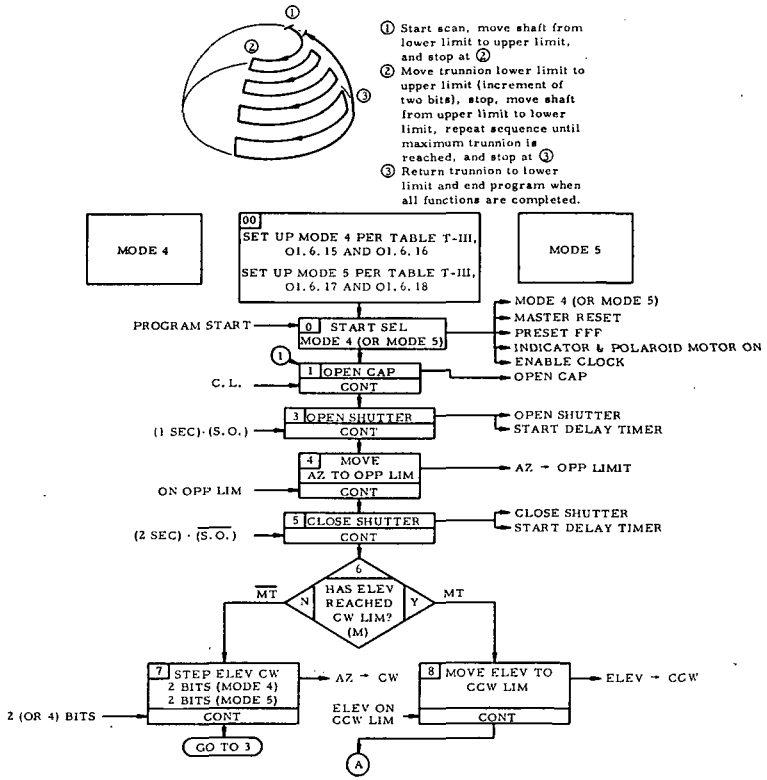
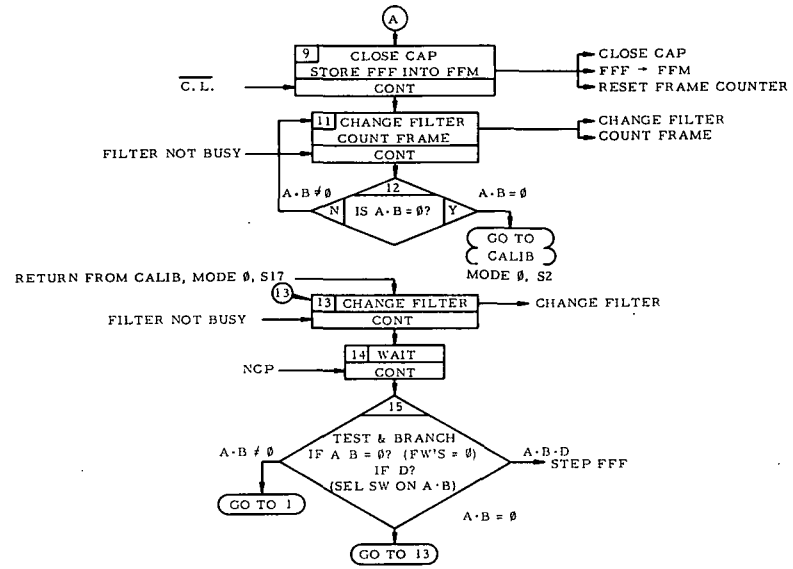


TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 63 of 81)

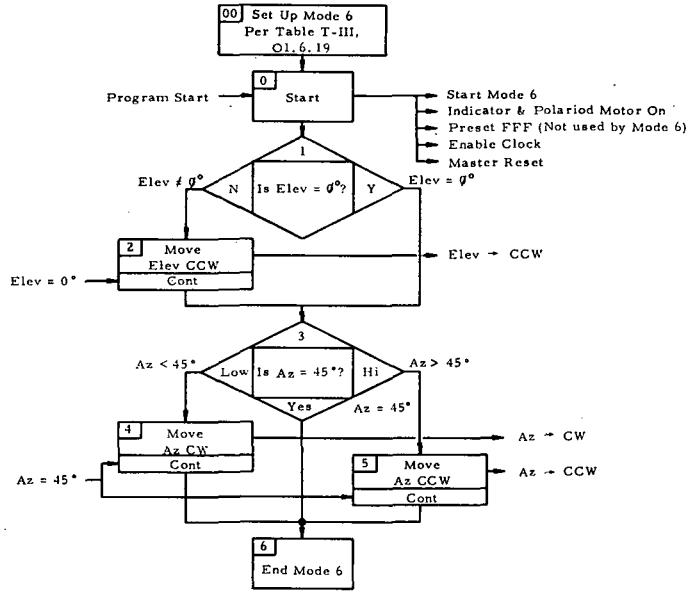
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Continued)					

NOTE: CAMERA FRAME IS AUTOMATIC

1. CAMERA FRAME EVERY 45° OF AZIMUTH
2. PROGRAM IS INHIBITED.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 64 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.1 (Concluded)					• Mode 6, Stowage Position Return The photometer head must be oriented to 0° (octal 000) in trunnion and 45° (octal 040) in shaft before retracting into the canister. Upon initiation of program start, these orientation positions are achieved regardless of photometer head position at the start. The shaft will respond first and then the trunnion. A Mode 6 programming format is presented below.



References 1, 7, 8, 9, 15, and 45.

The placard REPS refers to the number of repetitions or times an observing program or subprogram is to be performed. The system accepts octal numbers between 01 and 00. This means that the program can be repeated up to 64 times.

The octal number 01 represents 1 sequence and 77 represents 63 sequences. The octal number 00 is read as 100 and represents 64 sequences rather than 0 sequences.

In Modes 0, 1, 2, and 3, one sequence is defined as the completion of all the functions required in proceeding through the selected FW's.

MSFC - One Time Form 17 (March 1972)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 65 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
					In Modes 4 and 5, one sequence is defined as the completion of all the functions required in proceeding through one FW or position. In Mode 6 the sequence selection is arbitrary and has no significance. References 15 and 43 through 46.
3.5.1.3.4.1.3 Describe the orbital period adjust control and display function.				N/A	The proper selection of the octal digits on the orbital period adjust PBRS will duplicate the existing OA orbital period. The latitude of orbital period adjust is from 88 min 8 sec to 96 min and 24 sec. Since the photometer system, with the programmer, can operate unattended, and since periodic ground command dumps of onboard recorded data are possible, repetitive observing programs are both possible and desirable during eat-sleep-hygiene or during other long, unattended periods. The orbital period counter permits programs to be automatically performed during parts of consecutive orbits. The orbital period counter is a programmable timer that allows the astronaut to delay the start of each sequence in any multisequence scanning mode so that the program is repeated at the same point as the previous orbit. The orbital counter functions only when any number other than 00 is entered into two octal pushbutton rotary switches designated ORBITAL PERIOD ADJUST on the programmer panel. For the 00 entry, the programmer will step to the next sequence with no delay, i.e., the orbital timer is not in use in this condition. The counter is made up of two pulse-counting clocks in series. The first clock begins counting when the first sequence of any scan mode is started, and it counts for exactly 88 min. At the end of that time, it starts the second clock counting. The second clock is the programmable part of the time, and it will count for 8 sec for each octal digit set into the pushbutton switches. For example, 01 (octal) = 8 sec, 02 = 16 sec, up to 77 octal = 8 min 24 sec; these correspond to orbital periods from 88 min 8 sec, to 96 min 24 sec (equivalent to circular orbits ranging from 95 to 316 n. mi.). As the orbital counter proceeds with its count, the first scanning sequence continues to completion, the shutter closes, the photometer cap closes, and an ≈ 2 min calibration sequence is performed. When the output of the counter reaches the values selected with the period switches, a program start signal is generated and the counters are reset to zero. Also, the counter begins counting again on the first clock and simultaneously sends a signal to start the next sequence. This series of functions continues until the full number of programmed sequences is complete. References 15 and 43 through 46.
3.5.1.3.4.1.4 and 3.5.1.3.4.1.5 Describe the trunnion and shaft limit control and display functions.				N/A	The trunnion and shaft limits serve the function of permitting scans in trunnion or shaft over all or part of the sky. UPPER and LOWER refer to extremes in cw or ccw limits, respectively, when viewed from the canister end for shaft and when viewed from above for trunnion when the shaft position is 0°. The UPPER trunnion limit is that trunnion setting where the mount stops after scanning in a cw direction and the LOWER trunnion limit is that trunnion setting where the mount stops after scanning in a ccw direction. Therefore, any trunnion scan ranges from 0 to 112.5° and any segment within this range can be chosen by setting in the proper octal equivalent on the trunnion UPPER and LOWER rotary switches.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 66 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.3.4.1.4 and 3.5.1.3.4.1.5 (Concluded)					The same is true for the shaft limit switches except the range of shaft choice is 0 to 354°. References 15 and 43 through 46.
3.5.1.3.4.1.6 Describe the programmer light display function.				N/A	The programmer indicator light, when illuminated, indicates a program is in progress. The light will go off when the total program is complete. References 15 and 43 through 46.
3.5.1.3.4.1.7 Describe the camera program enable switch control function.				N/A	The camera program enable switch is a two-position toggle switch. When in the ENABLE position, the programmer controls the camera shutter operation and the FOV input determines the exposure time. In Mode 1, the camera system automatically takes one frame at the start of each filter position (every 12 sec). The camera system takes one frame for each 11.25° of trunnion scan in Mode 2 and one frame for each 45° of shaft scan in Modes 3, 4, and 5. The exposure time for each frame is automatically selected according to the FOV position in use at the time. The following table provides a tabulation of camera exposure times as a function of FOV position. FOV Position Versus Exposure Times FOV Position — Exposure Time (sec) 0 — 2-3/8 1 — 2-3/8 2 — 5/8 3 — 5/8 4 — 5/8 5 — 5/8 When the camera program enable switch is in the OFF position, the camera operation is inhibited. References 15 and 43 through 46.
3.5.1.3.4.1.8 Describe the power and control receptacle.				N/A	The T027/S073 automatic programmer's receptacle (J14) accepts the cable from the manual control panel at J10. References 15, 18, 41, and 45.

MSFC - One-Time Form 22 (July 1971)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 67 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.2 Specify the Pf_t for the universal extension mechanism (UXM).		0.44		IIIa	The UXM is an extendible/retractable scissors-like assembly containing 368 links and 44 spider assemblies. The UXM is designed to support the photometer head at seven rod lengths (approximately 18 ft) and two rod lengths (approximately 5 ft) when extended through either SAL. The photometer head is mechanically fastened to the UXM by two screw attachment knobs which will also accept the S-149 Motor Drive/Cassette and PCTVS camera head. An alignment stripe must be matched when attaching the head to the orientation yoke. An electrical connector (P1) is mated using alignment marks. This is accomplished so that electrical power can be delivered to the orientation mechanism. The cabling from the head end is routed along each of the four quadrants of the spider assemblies and is formed so as to coil when the UXM is retracted into the canister. The Pf for the UXM is considered nominal. If the UXM should fail, the following consequences are expected: • Mechanical --The UXM extendible/retractable assembly has moveable bars, links, spider assemblies, and cable bundles that can become susceptible to fouling and binding if the mechanism is not deployed or retracted correctly. If the extension rods are not properly engaged, or if the UXM is not preloaded prior to driving in shaft/trunnion, the mechanism can become unstable and hang-up the canister assembly while deploying/retracting the photometer head. • Support --If the UXM is ejected or cannot be deployed, experiment S-149 and the PCTVS will be lost. • Temperature --The connecting bars and links are subjected to varing temperature extremes in the orbital environment. The bars and links are subjected to relatively high temperature inputs when the deployed mechanism is located in the solar SAL on the earth's sun side, especially during high β-angle orbital periods. This temperature input could cause some warpage of the bars and links. When the UXM is deployed (seven rod lengths) in the earth's shadow, it is susceptible to cold temperatures that tend to contract and thereby cause binding of the bars and links. This situation would preclude UXM retraction. • Contamination --If moisture from the OA vent and dump operations collects on the bar and link pivot points, it may freeze the joints and cause the UXM to bind during retraction operations if the operations were accomplished during the earth shadow orbital period.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 68 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.2 (Concluded)					• Operability --If the UXM cannot be retracted into the canister assembly, the photometer head and attaching deployment hardware must be ejected. The crewman, deploying/retracting the photometer head can determine if the UXM is failed. If the required extension rods cannot be deployed and/or preloaded, or if the mast support tube cannot be retracted and latched, the UXM has failed and must be ejected. References 15, 18, 19, 22, 24, 41, 48, and 49.
3.5.1.4.3 Describe the orientation mechanism.				N/A	The shaft (azimuth) and trunnion (elevation) systems are part of the orientation mechanism that provides the capability to remotely point the photometer head. Pointing control is accomplished either by manual or automatic programming. Manual control is performed and the photometer directional position readout is observed at the common control panel. Automatic programming is performed with the automatic programmer in conjunction with the common and manual control panels. The detachable photometer head mounts to the trunnion yoke assembly which in turn fastens to the shaft hub assembly. The shaft hub assembly attaches to the end of the UXM. The shaft and trunnion systems are driven by two 400 Hz square wave synchronous electric motors. One motor is located at the shaft hub and the other motor is located at the trunnion yoke. Position encoders are mounted diametrically opposite to each motor. Each encoder output feeds the photometer circuit logic as well as the electro-luminescence readout on the common control panel, which indicates the angular position in octal. A relay and driver assembly is attached to the canister. A logic assembly printed circuit (PC) board, a driver assembly PC board and several separately mounted relays are mounted within the housing. The logic assembly PC board mounts gating components, and the driver assembly PC board mounts relay drivers. The drivers provide current for relay actuation and provide power for photometer head, shaft, and trunnion drive functions. The assembly also provides physical isolation for the relatively high electromagnetic interference signal carrying conductors. References 15, 22, 49, 50, and 51.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 69 of 81)

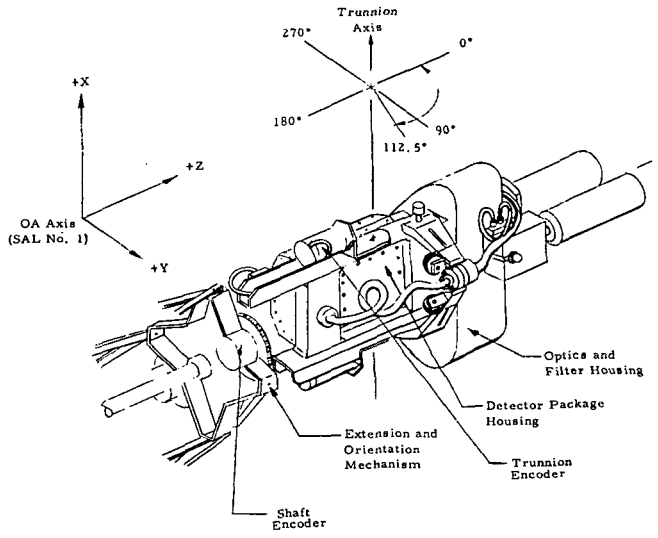
FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.1 Specify the P_{f_n} and P_{f_t} for the trunnion mechanism (elevation).		P_{f_t}=0.21		IIIa	The movement of the photometer head in trunnion, ranges from 0 (DECR limit) to 112.5° (INCR limit). Mechanical stops are provided at 358° (-2° ccw limit) and 112.5°, also see functional item 3.5.1.3.2.1.4.1:  The trunnion mechanism is driven by a 400 Hz 27 Vac rms square wave synchronous electric motor (B7) with a shaft speed of approximately 2 rpm after gear reduction. An additional 3 to 1 miter gear reduction directly drives the photometer in trunnion at a 4 deg/sec rate. Upon removal of motor power, a motor braking current is applied for approximately 1/2 sec to limit coasting overshoot. The motor also incorporates a magnetic back drive brake which will hold when up to 150 oz/in. are applied to the motor output shaft. The motor is fully reversible, performing scan operations in reverse and forward directions.

TABLE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 70 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.1 (Continued)		P_{f_n}=0.13			A 4.5 W patch heater is bonded to the motor housing to maintain motor performance under cold operational extremes. Heater power is applied whenever the experiment power switch is ON. There is no thermostatic control for the patch heaters. The trunnion encoder (M2) is mounted on the trunnion yoke and miter geared at 1:1 ratio to the movable portion of the trunnion system. The encoder is constructed with eight rows of segments on the circumference of a cylinder. The 8 rows are formed with the following number of segments: 2, 4, 8, 16, 32, 64, 128, 256. A wiper contacts each row and by sensing the presence of a segment the photometer trunnion position can be determined within an accuracy of approximately 1.4°. This information is used as input to the automatic programmer logic to stop trunnion movement prior to contacting the mechanical stops, or to maintain the movement within the limits set on the automatic programmer panel. DS-2 is displayed on the common control panel in octal. Each angle change of 1.4° will advance the readout one number octal. A cross correlation table at 15° increments is: Trunnion Degree Elevation / Octal Readout 0° / 000 15° / 013 30° / 025 45° / 040 60° / 052 75° / 065 90° / 100 105° / 112 112.5° / 120 The P_f for the trunnion mechanism is considered nominal. If the trunnion mechanism should fail, the following situations could occur: • Electrical --If power cannot be applied to B7, the capability to control, scan, point, and determine the elevation of the photometer head is lost. --If the trunnion encoder (M4) fails, photometer head elevation position cannot be determined using DS-2. • Communications and Data --Loss of the trunnion mechanism means that the experiment cannot accomplish all the mission functional objectives.

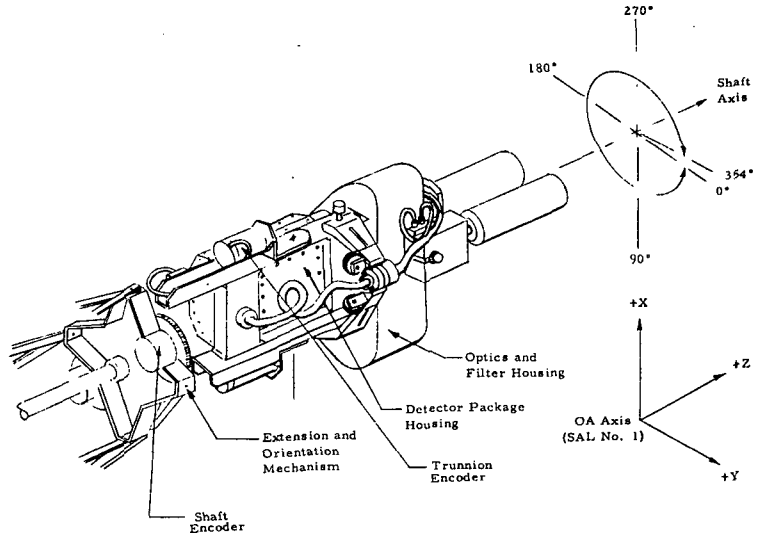
MSFC - One-Time Form 22 (July 19--)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 71 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.1 (Concluded)		P_{f_n}=0.08			• Temperature --If the B7 patch heater were to fail, it could cause the motor bearing sealed lubricants to either increase resistance and reduce motor drive rate or harden and preclude motor drive capability. • Pointing and Control --Refer to the Electrical Interface above. • Operability --To retract the photometer head, DS-2 should indicate octal 0. This means that the photometer head is orientated 0° elevation and satisfies the trunnion retraction requirement. If the trunnion cannot be positioned to octal 0, the photometer head will probably be ejected. The astronaut and ground personnel can determine trunnion mechanism failure by monitoring DS-2 and the appropriate trunnion telemetry measurements (see functional items 3.5.1.3.2.4.1 and 3.5.1.3.2.4.2). References 15, 22, 24, 50, 52, and 53.

MSFC - One-Time Form 22 (July 197[illegible]

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 72 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.2 Specify the P_{f_n} and P_{f_t} for the shaft mechanism.		$P_{f_t} = 0.18$		IIIa	The movement of the photometer head in shaft rotates from 0 (DECR limit) to 354° (INCR limit. Mechanical stops are provided at 355 and 358° (i.e., -2° for ccw limit); also see functional item 3.5.1.3.2.1.3.1:  The shaft motor (B6) and gear reduction are identical to the trunnion system configuration. The gearing external to the motor output shaft is a 3 to 1 spur gear reduction and directly drives the photometer in shaft at 4 deg/sec. The shaft encoder (M3) operation and DS-1 are identical to that of the trunnion system except that the range is greater. A correlation table of shaft angle and octal readout at 45° increments follows:

MSFC - One-Time Form 22 (July 197[illegible]

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 73 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER*	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.2 (Continued)		$P_{f_n} = 0.10$ $P_{f_n} = 0.08$			Shaft Degree Azimuth / Octal Readout 0° 000 45° 040 90° 100 135° 140 180° 200 225° 240 270° 300 315° 340 354° 374 A patch heater, similar to that described in functional item 3.5.1.4.3.1, is used in B6. The P_f for the shaft mechanism is considered nominal. If the shaft mechanism should fail, the following effects would be similar to those experienced for the trunnion mechanism (see functional item 3.5.1.4.3.1): • Electrical --If power cannot be applied to B6, the capability to control, scan, point, and determine the azimuth of the photometer head is lost. --If the M3 fails, photometer head shaft position cannot be determined when monitoring DS-1. • Communications and Data --Refer to functional item 3.5.1.4.3.1. • Temperature --Refer to functional item 3.5.1.4.3.1. The same failure effects will apply to B6. • Pointing and Control --Refer to the Electrical Interface above. • Operability --The retraction position for the photometer head in shaft is octal 040 (45°) and should be displayed on DS-1. If the shaft cannot be positioned to octal 040, it may be possible to manually acquire one of the following alternate positions:

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 74 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.3.2 (Concluded)					Shaft Degree Azimuth / Octal Readout 135° / 140 225° / 240 315° / 340 The photometer head can probably be retracted if one of the alternate shaft positions is acquired. If the photometer head cannot be retarcted it will be ejected. The astronaut and ground personnel can determine shaft mechanism failure by monitoring DS-1 and the appropriate shaft telemetry measurements (see functional items 3.5.1.3.2.1.3.1 and 3.5.1.3.2.1.3.2). References 15, 22, 24, 29, 53, 54, 55, 56, and 57.
3.5.1.4.4 Describe the photometer head assembly.				IIIa	The photometer head assembly is a light measuring system that has shutters, an optical train, and photoelectric counter. A 16mm DAC is aligned collinear with the photometer optics so that sequence photographs may be taken for reference. Sunshields are provided for both the photometer and camera systems to limit extraneous light and allow data acquisition to within 18° of the sunline. The DAC is GFE and will not be considered as part of the T-027/S-073 preflight operations evaluation analysis. The optical train is referred to as a Fabry photometer because of its optical system design. The optical system objective lens (A) is followed by a Ross zero-corrector refocusing lens (B) which reduces convergence of the beam to a value close to that of the light incident on the objective lens. Interference filters and a polarization analyzer are located in this partially collimated beam between the equal-curvature negative and positive lenses of the zero-corrector. The positive element is considered as the collimating lens (C). The FOV is determined by an FOV wheel which is located in the focal plane and can be indexed to a 1, 3, or 6° FOV aperature. A field lens (D) system focuses an image of the objective on the cathode of the PMT. The detector package contains a PMT with a solid state thermo-electric cooling circuit, a high voltage power supply, an output voltage differential amplifier, and a PMT temperature sensing circuit for telemetry. The detector's sensitivity is in the 4000 to 8200 Å range. A solid state thermal electric cooler (TEC) is used to cool the PMT cathode. This stabilizes the PMT output and reduces the PMT dark current (PMT output with no light input) value. The PMT amplifier converts the PMT output signal (0 to 1 μA) to 0 to 10 V. This signal is routed down the UXM to a 12.5 gain amplifier in the canister electronics (common control panel). The detector package is GFE and will not be considered as part of the T-027/S-073 preflight operations evaluation analysis.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 75 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.4 (Concluded)					References 15, 19, 29, and 58.
3.5.1.4.4.3.2 Specify the P_{f_n} and P_{f_t} for the FOV assembly.		$P_{f_t} = 0.20$		IIIa	The photometer head incorporates a system that makes it possible to change the FOV and to reduce the amount of light incident upon the PMT. This is done by placing aperatures of varying diameters with or without neutral density filters into the optical path of the photometer. An FOV wheel is designed within the photometer and has six openings: FOV Wheel Position — Aperature (deg) 0 — 6° 1 — 3° 2 — 3° plus 2.0 neutral density filter 3 — 3° plus 3.0 neutral density filter 4 — 1° 5 — 1° plus 4.0 neutral density filter The FOV wheel is indexed into any one of six positions by the 28 Vdc B3 and Geneva mechanism. The output of the Geneva drive is geared to the periphery of the FOV wheel. Selection of the desired FOV/neutral density position is performed manually from the manual control panel. The neutral density filters will cancel the light in all colors of the spectrum. Position indication is accomplished by a plunger switch ($S1_{FOV}$) FOV wheel cam contact at the 6° FOV (position zero) only. FOV wheel positions stepped off from position zero are electrically synchronized with the position indication circuit. When photometer power is removed, the FOV physical position and FOV readout may lose synchronization. If, on power application, the numeral eight is indicated on the FOV readout, the FOV switch on the manual control panel must be actuated until the readout indicates zero. At this point, the FOV readout is synchronized. The P_f for the FOV assembly is considered nominal. If the FOV assembly should fail, the following problems could occur: • Electrical --If B3 fails, the FOV settings for various photometer scan programs would be lost. The FOV wheel cannot rotate. --If $S1_{FOV}$ fails open, the FOV readout (DS-3) would not indicate the wheel position. If the $S1_{FOV}$ fails closed, DS-3 will only indicate FOV position zero when manual control panel switch S5 is operated
		$P_{f_n} = 0.11$			

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 76 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.4.3.2 (Concluded)		$Pf_n = 0.09$			• Communications and Data --Telemetry measurements K7275Z027 (K7275T027), K7273Z027 (K7273T027), and K7274Z027 (K7274T027) will not change state if B3 fails to rotate the FOV wheel. • Environmental --The neutral density filter material may become degraded as the photometer head passes through the South Atlantic Anomaly (SAA). The radiation found in the SAA could increase the filter density and thereby bias the PMT output measurement signal. • Operability --The DAC film exposure time is determined by the FOV settings (see functional item 3.5.1.3.4.1.7). If the FOV wheel fails in position 0 or 1, the DAC exposure time is 2 3/8 sec; if the FOV wheel fails in positions 2 through 5, the DAC exposure time is 5/8 sec. The astronaut and ground personnel can determine if the FOV wheel fails by monitoring the appropriate readout and telemetry measurements (see functional items 3.5.1.3.3.3.1 and 3.5.1.3.3.3.2). References 15, 19, 22, 29, 37, and 58.
3.5.1.4.4.3.3 Specify the Pf_t for the PMT shutter assembly.		0.22		IIIa	The PMT shutter is a metal paddle assembly located within the lens system of the photometer. It is positioned between lens C and the FOV wheel. Its purpose is to protect the detector against exposure to excessively high light energy sources and to obtain reference dark current values. The PMT shutter is controlled open and closed by L2. The PMT shutter is closed whenever an automatic mode sequence is completed, whenever FW A or B are in motion or stopped at positions zero, whenever photometer power is removed, and whenever PMT over-voltage is sensed. The PMT shutter position is sensed by magnetic proximity switch $S2_{L2}$. The switch is actuated in the open position. The P_f for the PMT shutter assembly is considered nominal. If the shutter assembly fails, the following situations would occur: • Electrical --If the shutter assembly fails closed, the PMT cannot measure the light intensity and dark current calibration intensity. If the shutter fails open, there is no impact against the photometer's capability to measure light intensity; but, care must be exercised not to point the photometer head sunshield at the sun when the PMT cap is open. --The shutter will not open if L2 fails. --If power is removed from L2 while the shutter is open, the shutter will close.

MSFC - One-Time Form 22 (July 197-)

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 77 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.4.3.3 (Concluded)					• Communications and Data --If the PMT shutter fails closed, telemetry measurement data for the PMT (M7074T027) will be lost. • Operability --If $S2_{L2}$ fails, the DS-4 on the manual control panel will not properly display the shutter's position (see functional items 3.5.1.3.3.5.1.1 and 3.5.1.3.3.5.1.2). The astronaut and ground personnel can determine a PMT shutter failure by monitoring the appropriate readout and telemetry measurements (see functional items 3.5.1.3.5.3.5.1.1. and 3.5.1.3.5.3.5.1.2). References 15, 19, 22, 29, 37, 58, 60 and 61.
3.5.1.4.4.5.1 Specify the P_{f_t} for the polarizer assembly.		0.24		IIIa	The photometer utilizes a coupled rotating polaroid half-wave synchronous (phase sensitive) detector. The polarizer wheel, located between the zero-corrector lenses of the photometer optical system, is 3.9 in. in diameter and rotates continuously at 2 rps when the system is operating. The polarization wheel is driven by a 27 V 400 cycle servo-motor (B4) that is geared to the periphery of the wheel. The polarizer wheel drives an encoder (M1) whose position is sampled 320 times/sec by the AM data system and is correlated to the polarization plane orientation. The light passing through the rotating polarization analyzer at any instant defines that polarization component. The summation of all of the polarization components yields the total light observed. The P_f for the polarizer assembly is considered nominal. If the polarizer assembly should fail, the following consequences are expected: • Electrical --If B4 fails, the ability of the photometer to distinguish the polarization components of light will be lost. --If S4 or the automatic programmer fails open, B4 and M1 will not operate. • Communications and Data --If M1 fails, telemetry measurement K7170T027 will be lost. Only the ground personnel can determine the failure of the polarizer assembly by monitoring the change in state of the K7170T027 polarizer wheel synchronization telemetry signal. The astronaut has no cue to determine polarizer wheel failure. References 15, 19, 22, 24, 29, 37, 58, and 62.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 78 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.4.5.2 Specify the Pf_t for the FW system.		0.29		IIIa	The photometer incorporates a system of interference filters located between the equal-curvature negative and positive lenses of the zero-corrector. Any one of 10 filters can be placed into the optical path of the photometer by selectively positioning 2 FW's each of which holds 5 filters (a sixth position is left open). The filters have the following characteristics:

	FW Position	Wavelength of Maximum Transmission (Å)	Half-transmission Bandwidth, B/W (Å)
	A0	Open	
	A1	4000	116 ± 10
FW A	A2	4760	50 ± 5
	A3	5080	54 ± 5
	A4	5300	58 ± 5
	A5	5577	20 ± 3
	B0	Open	
	B1	6080	88 ± 10
FW B	B2	6300	20 ± 3
	B3	6435	108 ± 10
	B4	7100	150 ± 15
	B5	8200	250 ± 25

Filter characteristics are sensitive to temperature variation from the design nominal and therefore a temperature sensing diode (CR5) is provided to allow data correlation. The diode has an accuracy of ± 2 °C over a range of -40 to 70 °C. The interference filter reflects rather than absorbs unwanted wavelengths.

Each FW is driven by a 27 Vdc stepping motor (B2 for FW A and B1 for FW B) through a Geneva mechanism and a gear train that meshes with the gear teeth on the periphery of the FW. Any filter can be selectected manually from S6 on the manual control panel and can be sequentially stepped through during an automatic calibration. Each FW A and B position indication is accomplished by a plunger switch ($S4_{MSW\ A}$ for FW A and $S3_{MSW\ B}$ for FW B) and cam contact at the (open hole) position only. FW positions that are stepped off from position 0 are electrically synchronized with the position indication circuit. When photometer power is removed, the FW physical position and FW readout (DS-3) may lose synchronization. If, on power application, the numeral eight is indicated on either FW readout, and the FW switches on the manual control panel must be actuated until each readout (A and B) indicates zero. At this point, the FW's are synchronized.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 79 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.4.5.2 (Concluded)					The P_f for the FW system is considered nominal. If the FW system fails, the following situations would occur: • Electrical --If B1 and B2 fail, the FW A and B positions for various photometer scan programs will be lost. The chances of both motors failing at the same time is considered remote. --If $S3_{MSW\ B}$ and $S4_{MSW\ A}$ fail, the DS-3 readout will not properly display the FW positions (see functional items 3.5.1.3.3.2.1, 3.5.1.3.3.2.2, and 3.5.1.3.3.2.3). • Communications and Data --If CR5 fails, telemetry measurement C7068Z027 or C7068T027 will be lost. --If B1 and B2 fail, telemetry measurements to indicate FW position will be lost (see functional item 3.5.1.3.3.2.1). --If the FW plunger switches S3 and S4 fail, the telemetry measurements K7313Z7294 or K7313K7294 and K7299Z7292 or K7299K7292 will be lost. • Support --If DS-3 fails, the S-149 cassette opening/closing displays will be lost (see functional item 3.5.1.3.3.2.3). The crewman and ground personnel can determine if the FW's fail by monitoring the appropriate control panel displays and telemetry measurements (see functional items 3.5.1.3.3.2.1, 3.5.1.3.3.2.2 and 3.5.1.3.3.2.3). References 15, 19, 22, 24, 29, 37, 58, and 63.
3.5.1.4.6 Specify the P_{f_t} for the PMT cap, and temperature sensor housing assembly.		0.20		IIIa	The PMT cap/shutter is a metal disc located immediately in front of the objective lens and whose purpose is to position a light calibration source in the optical train. The PMT cap is designed to pivot out of the FOV of the photometer by the operation of L1 and bell crank mechanism. The PMT cap can be controlled either manually or automatically. The PMT cap will close during Mode 0 calibration at the completion of an automatic mode and whenever power is removed from the photometer. The PMT cap position is sensed by a magnetic proximity switch ($S5_{L1}$). The switch is actuated in the open position. The rear face of the PMT cap mounts a promethium-activated, blended-phosphor standard light source. This is used as a calibration source for the photometer system and is isolated from the optical train when the PMT cap is in the OPEN position. A temperature sensing diode (CR6) is located on the PMT cap. The diode has an accuracy of ±36 °F over a range of -40 to 158 °F.

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 80 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.6 (Concluded)					The P_f for the PMT cap and temperature sensor housing assembly is considered nominal. If the assembly fails, the following effects would occur: • Electrical --If the cap fails open, the PMT cannot measure the dark current calibration intensity. --If power is removed from the L1 while the cap is open, the cap will close. • Communications and Data --If the PMT cap fails closed, telemetry measurement data for the PMT (M7074T027) will be lost. --If CR6 fails, telemetry measurement C7066Z027 or C7066T027 will be lost. • Operability --If $S5_{L1}$ fails, DS-4 readout will not properly display the cap's position (see functional item 3.5.1.3.5.3.2.2). The crewman and ground personnel can determine a PMT cap and temperature housing failure by monitoring the appropriate manual control panel readout and telemetry measurements (see functional items 3.5.1.3.3.5.2.1 and 3.5.1.3.3.5.2.2). References 15, 19, 22, 24, 29, 37, 61, and 63.
3.5.1.4.7 Describe the sunshields.				N/A	Sunshields are provided for the photometer and the 16mm DAC to shield out extraneous light and to permit observations to within 18° of the sun. The photometer sunshield FOV is 6° and the DAC sunshield FOV is 15°. The sunshields are of two piece construction; the detachable extension segment (solar-sunshield) is removed and stowed when the photometer is installed in the anti-solar SAL. The solar sunshield, when attached, improves the extraneous light rejection qualities of the system but has the adverse result of reducing the objective aperature. A sunshield cover is provided to cover the inlet end of the solar sunshield (one unit covers both the photometer and the DAC solar sunshield), when the photometer is stowed or when the solar sunshield has been removed from the photometer. When the solar sunshield is removed and temproarily stowed, dust caps are provided to cover the aft end of the solar sunshield. The solar sunshield cover and dust caps are required to minimize contamination within the area of the sunshields. References 15, 18, 19, 22, 29, 64, 65, 66, and 67.

MSFC - One-Time Form 22 (July 197[illegible])

TABLE T-I. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT PRE-FLIGHT OPERATIONS EVALUATION ANALYSIS (Sheet 81 of 81)

FUNCTIONAL BLOCK NUMBER AND TITLE	EXPECTED RANGE AND DIMENSION OF VARIABLES			CRITICALITY CATEGORY NUMBER	REMARKS
	MIN.	NOM.	MAX.		
3.5.1.4.9 Describe the camera system.				N/A	A 16mm DAC (GFE) is mounted on the photometer head. The DAC provides sequential photographic images of an FOV that is collinear with and overlaps that of the photoelectric photometer. It consists of a camera lens and a Model 308B 16mm Mauer camera. The lens is an f/0.95 with a focal length of 25mm. The camera system line-of-sight is parallel to the photoelectric photometer line-of-sight within ± 1°. The DAC settings are as follows and should not be changed: • Focus = 00 • f Stop = 0.95 • Shutter Speed = 1/60 • Exposure = Time. The DAC uses 3 film magazines, each loaded with 140 ft of 2485 film. References 15, 19, 22, 29, and 68.
3.5.1.5 Describe the stowage container.				IIIa	The stowage container provides stowage and environmental protection for the photometer system. The top of the container is the work station for attachment of the photometer canister during installation and removal of the photometer head, S-149, PCTVS, and film loading/unloading operations. The container is constructed of aluminum, and is vented through a 50 µm filter to maintain cleanliness and to withstand decompressing. The interior is fitted with six shock isolators and attach points to accept the Calfax fasteners provided on the photometer system canister. The power cable (40M32749) and instrumentation cable (40M32750) are stored in the lid portion of the stowage container. References 15, 22, 69, and 70.

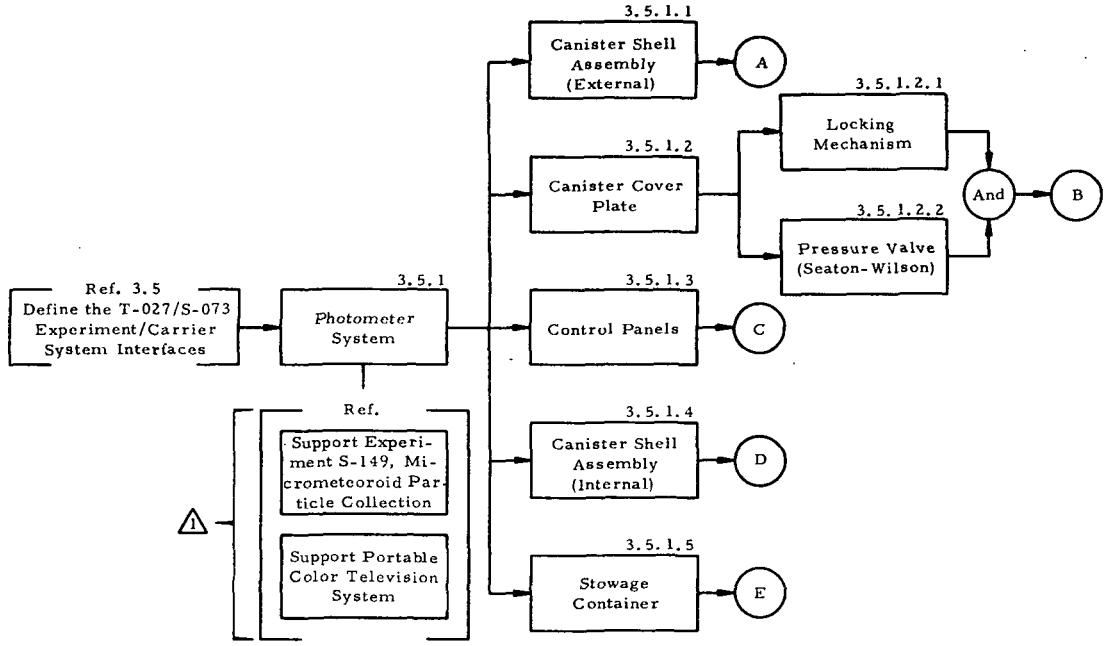


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 1 of 14)

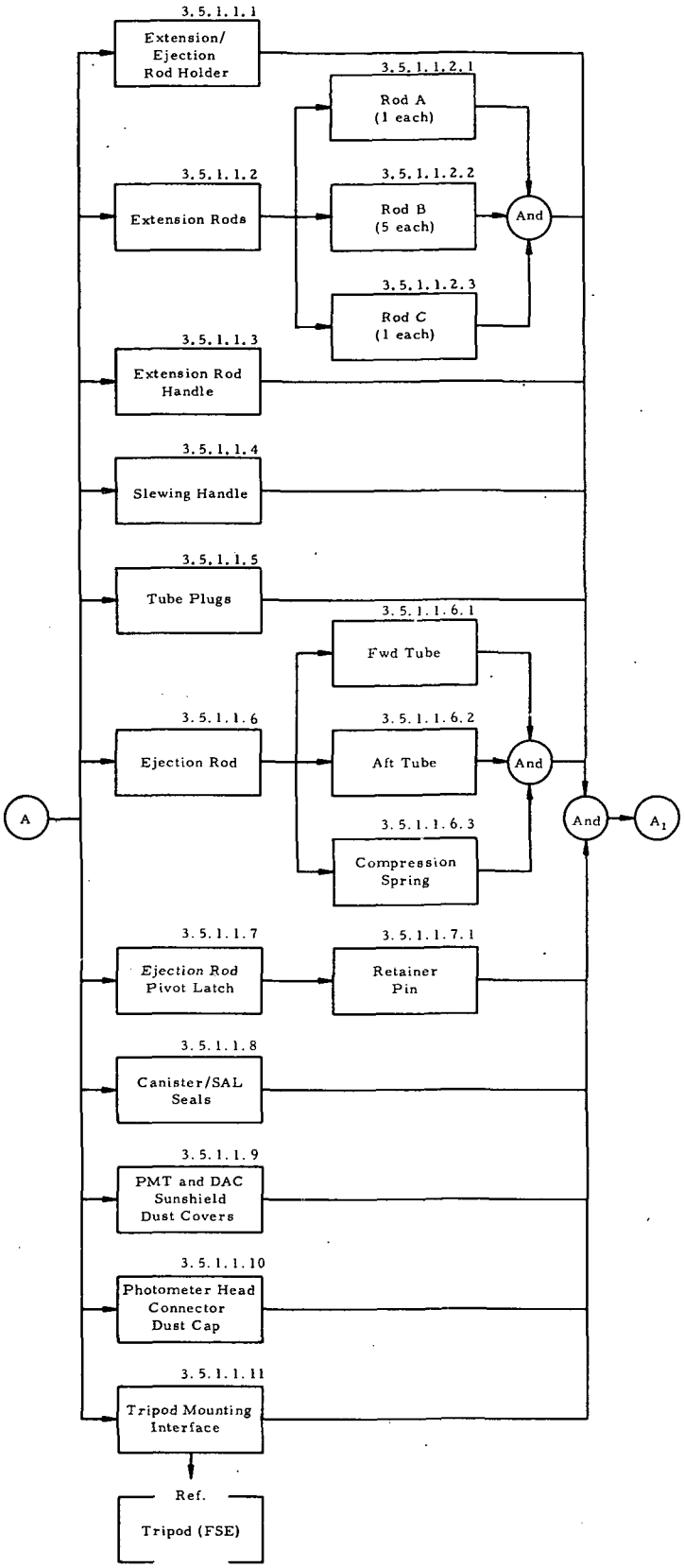


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 2 of 14)

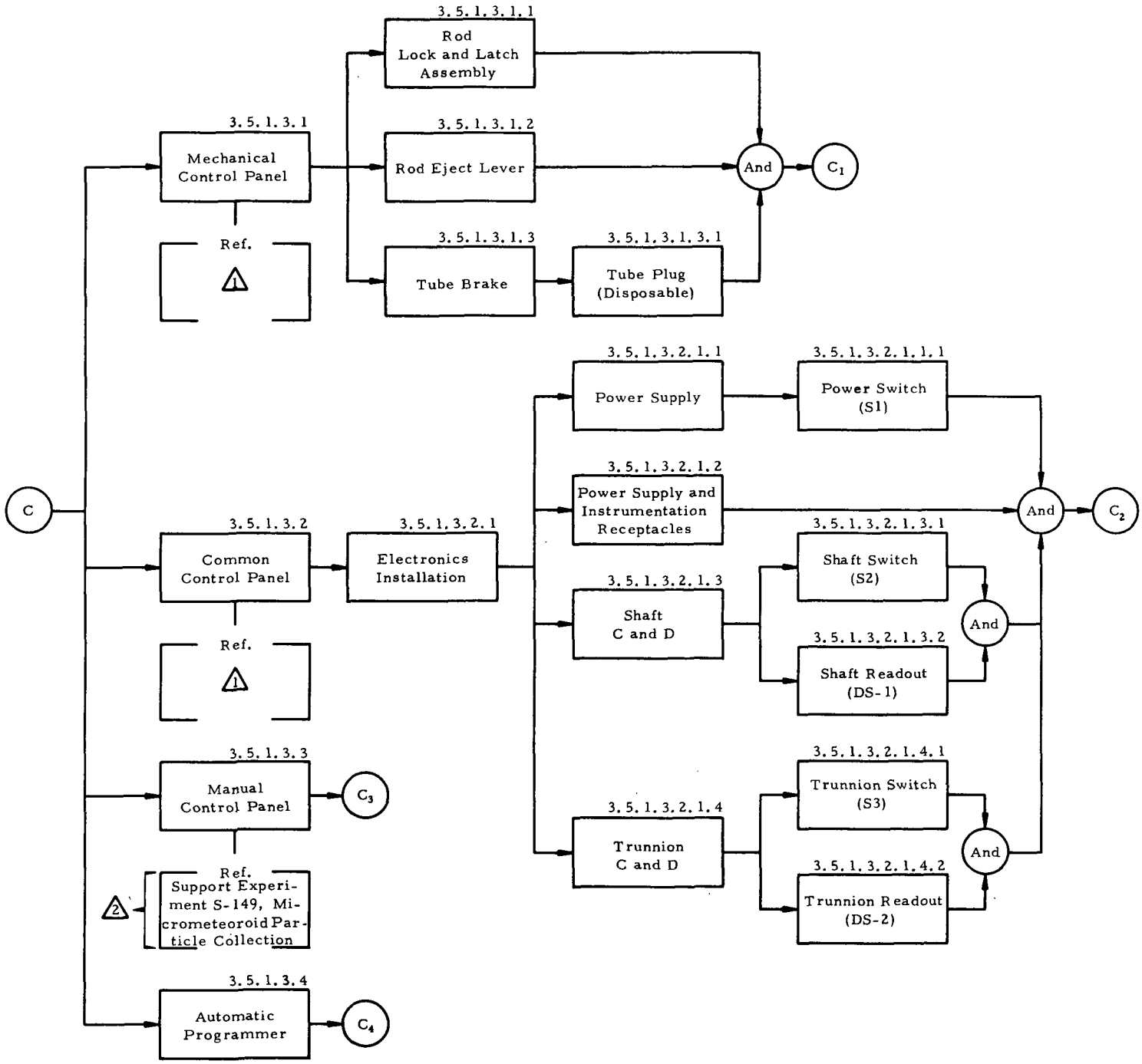


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 3 of 14)

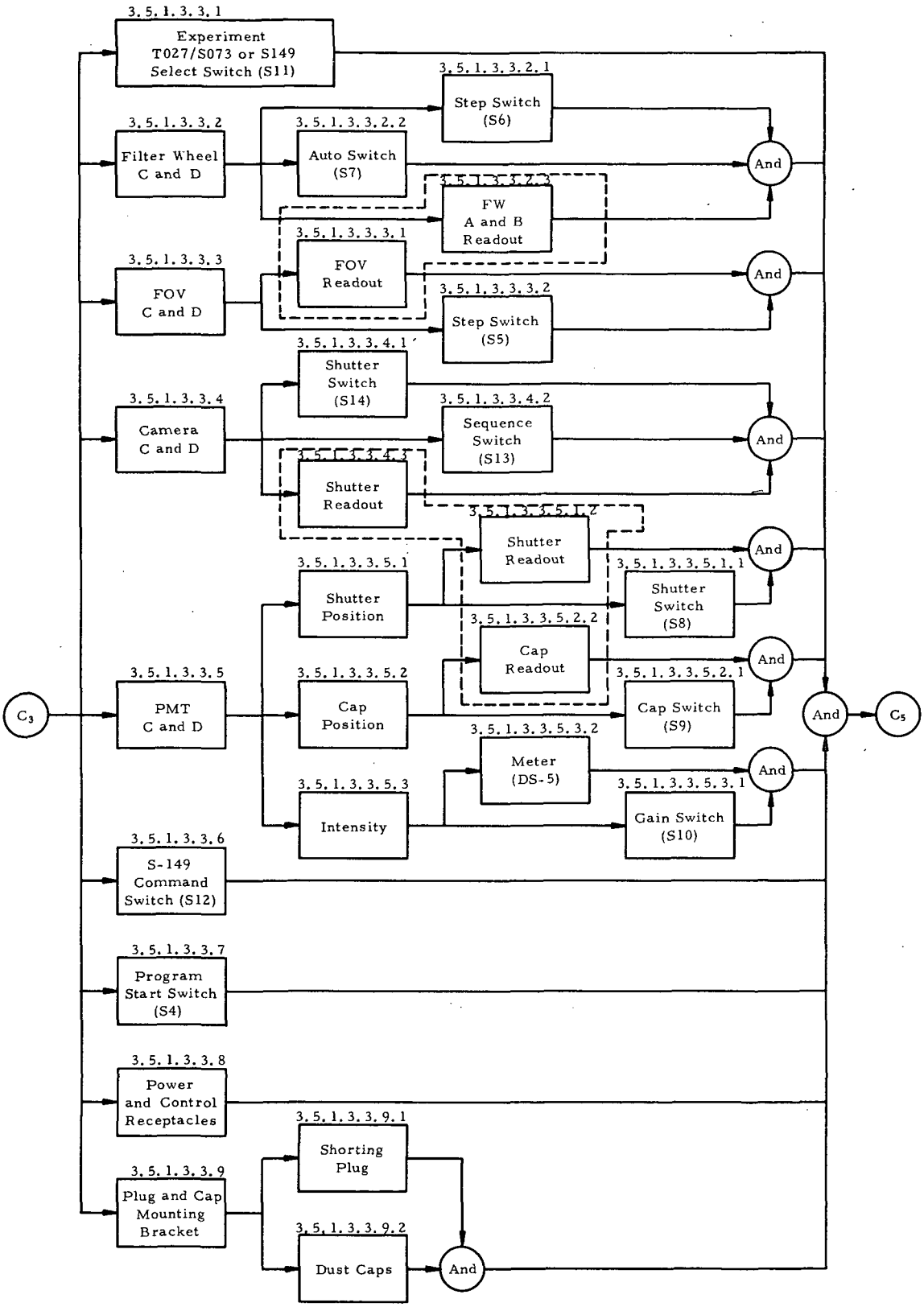


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 4 of 14)

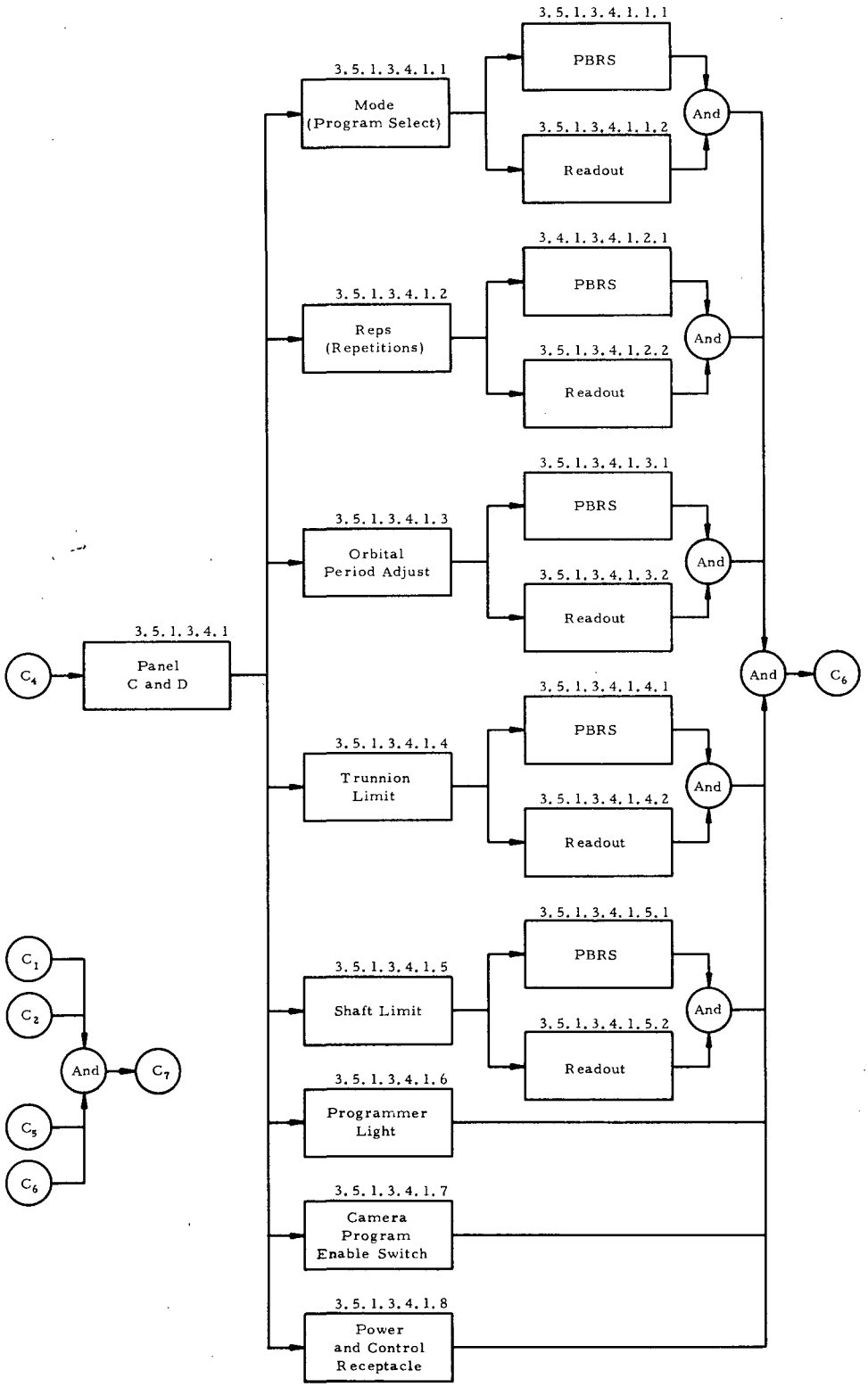


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 5 of 14)

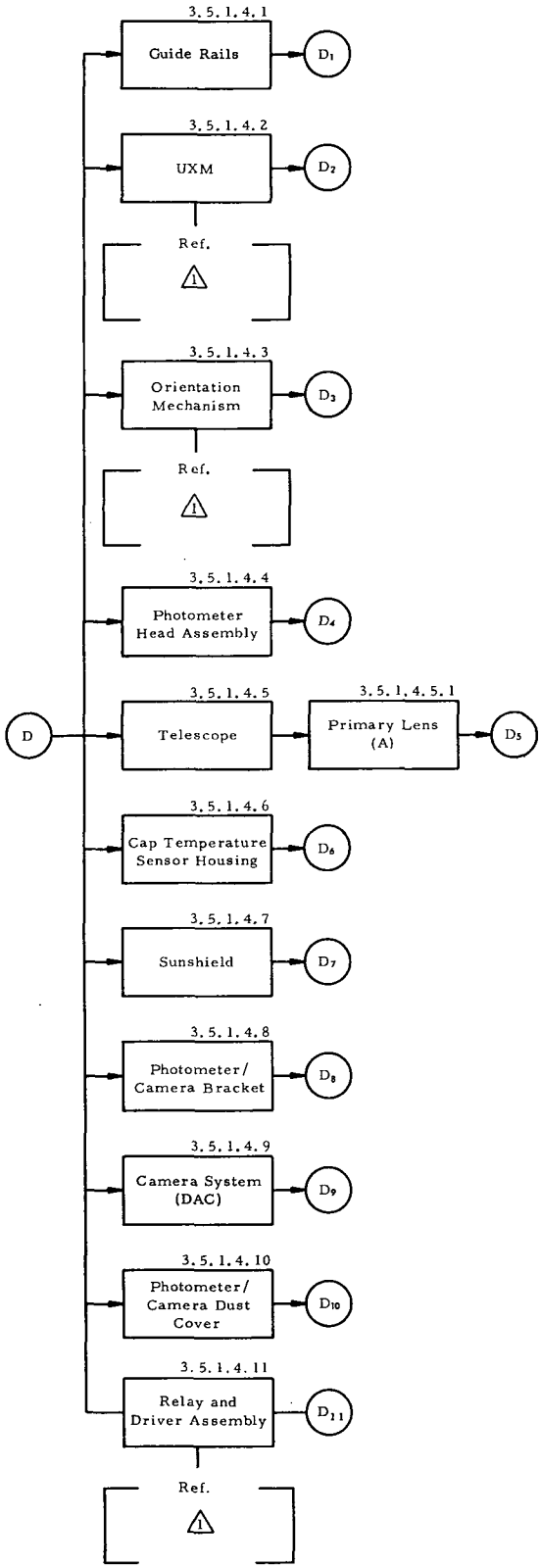


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 6 of 14)

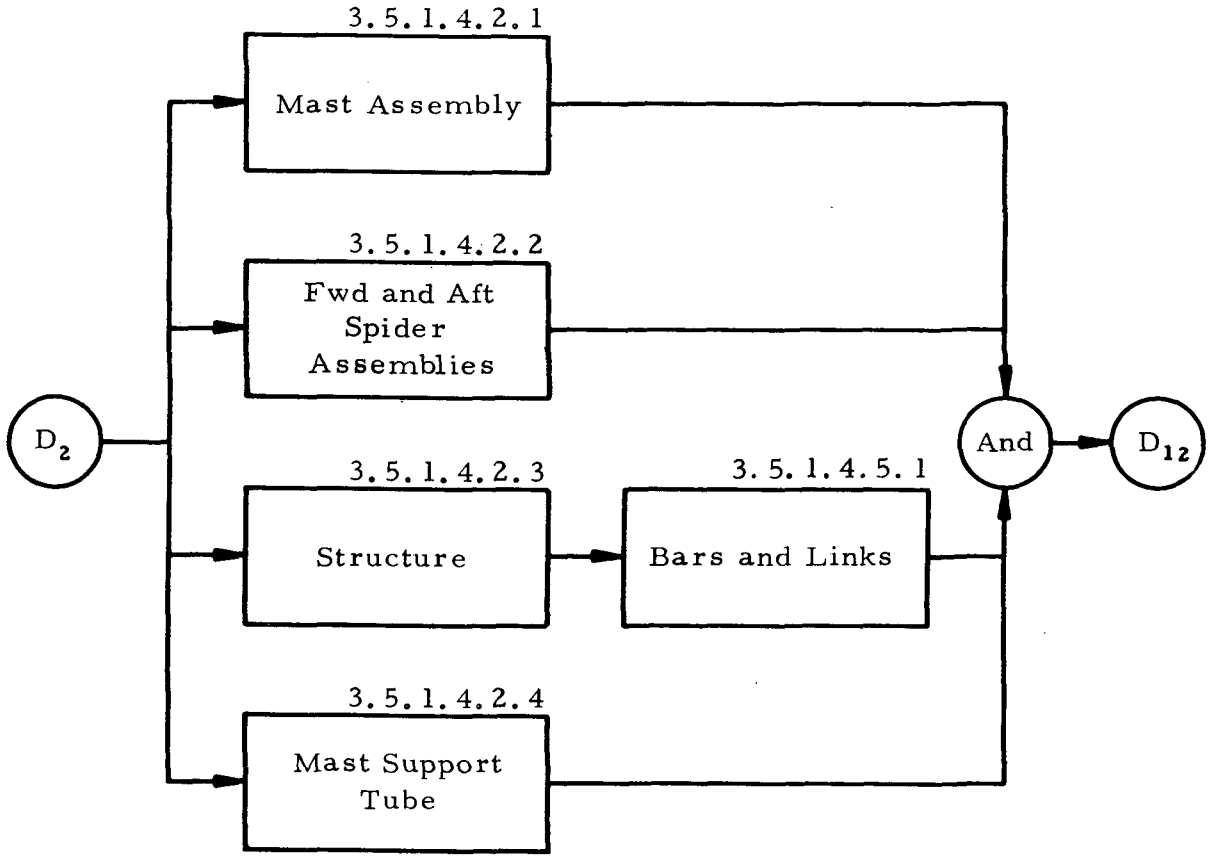


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 7 of 14)

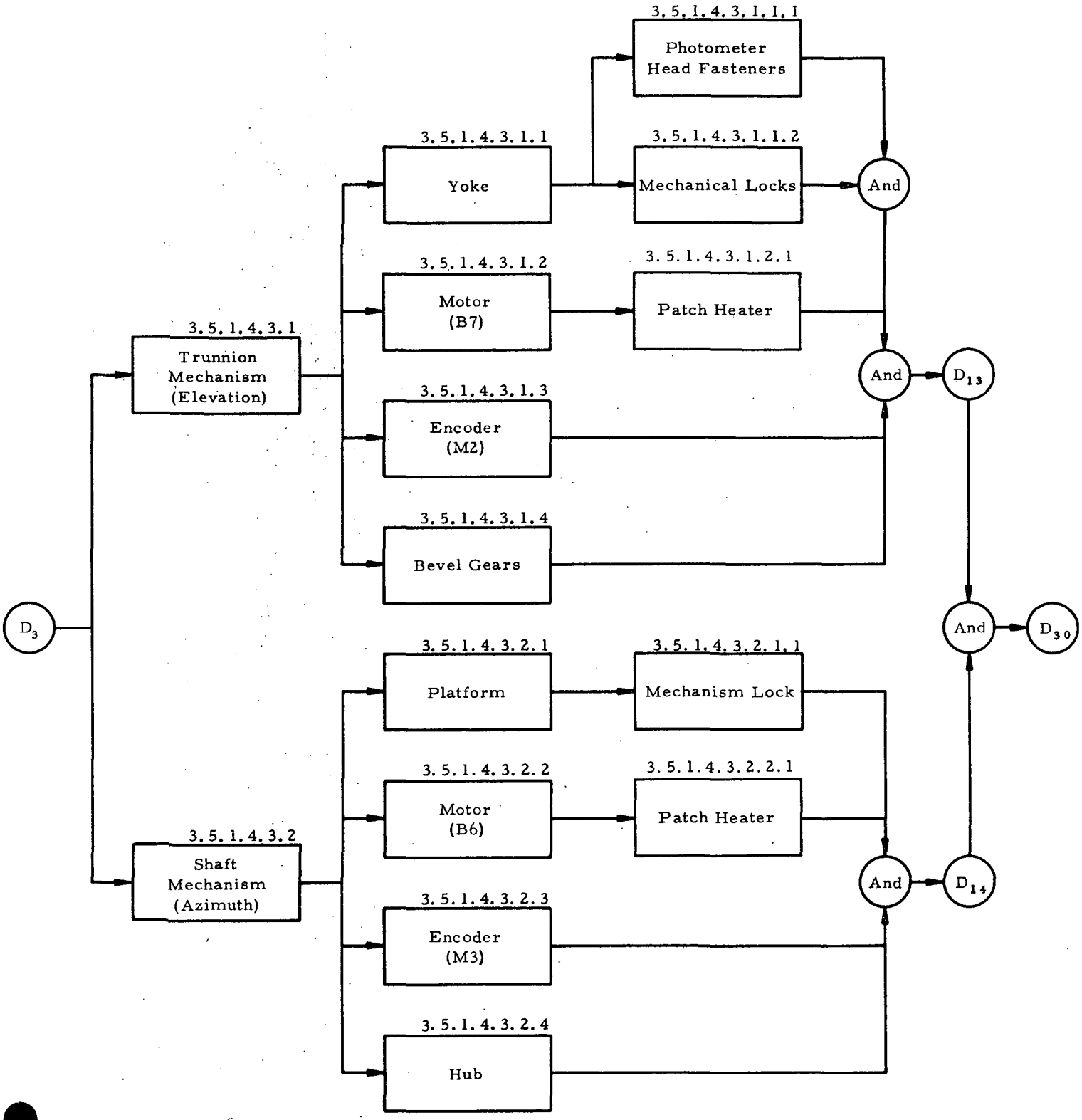


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 8 of 14)

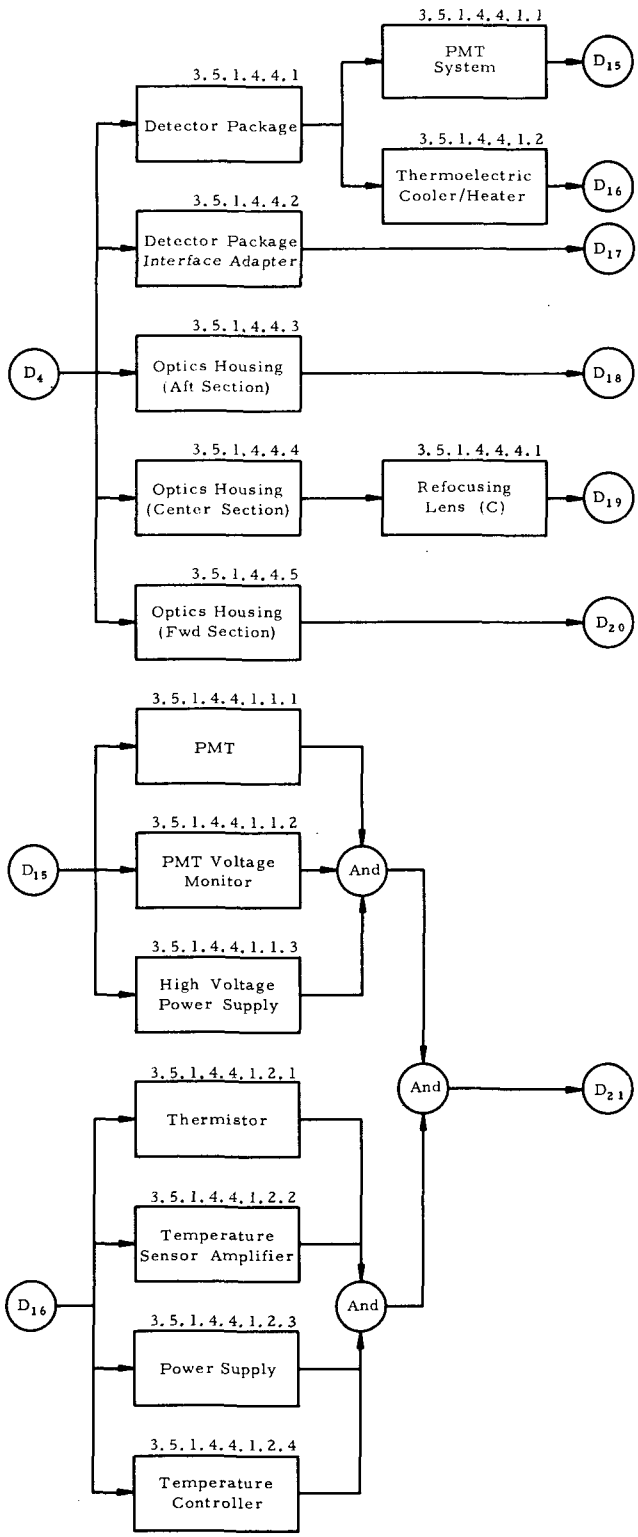


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 9 of 14)

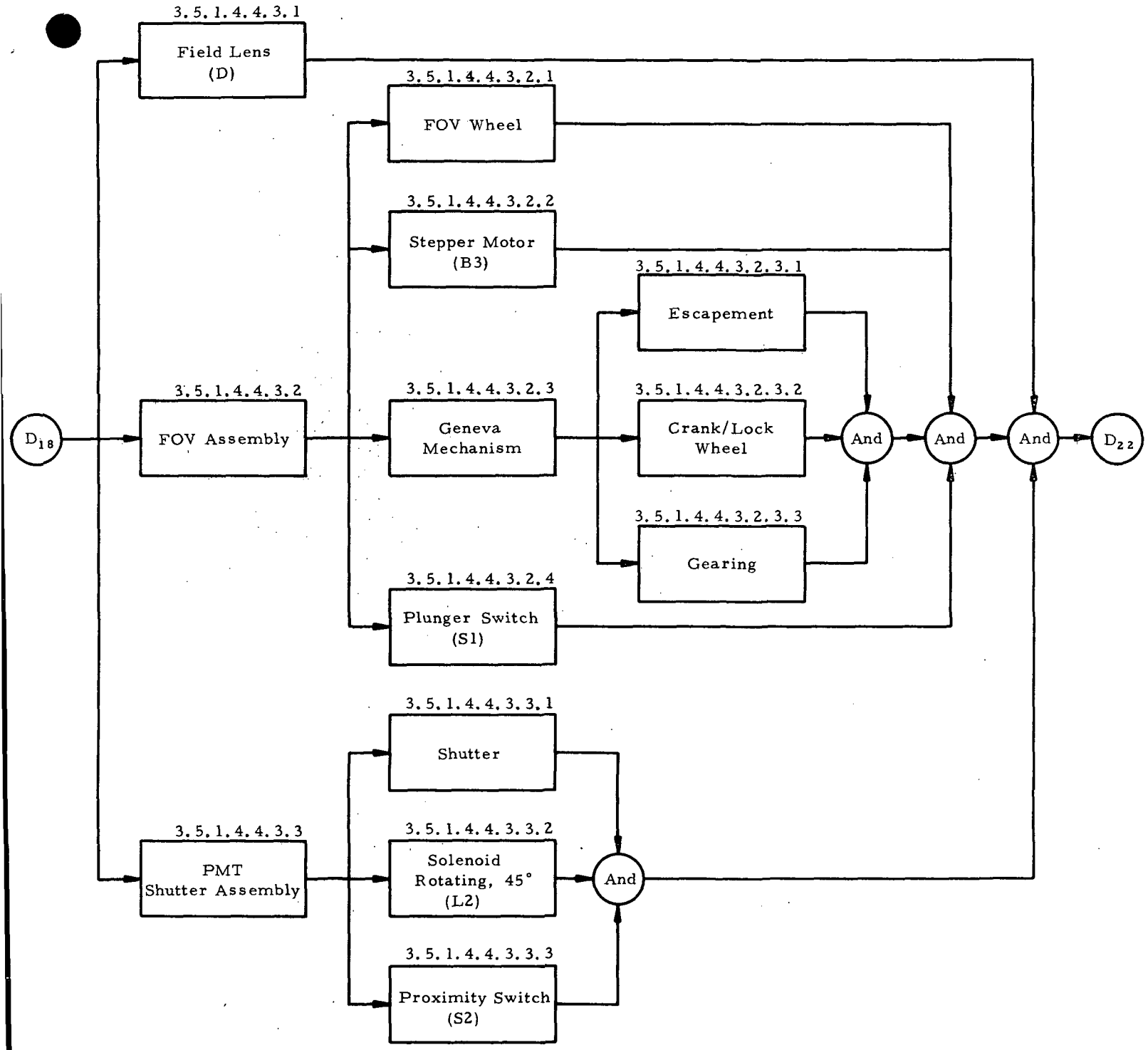


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 10 of 14)

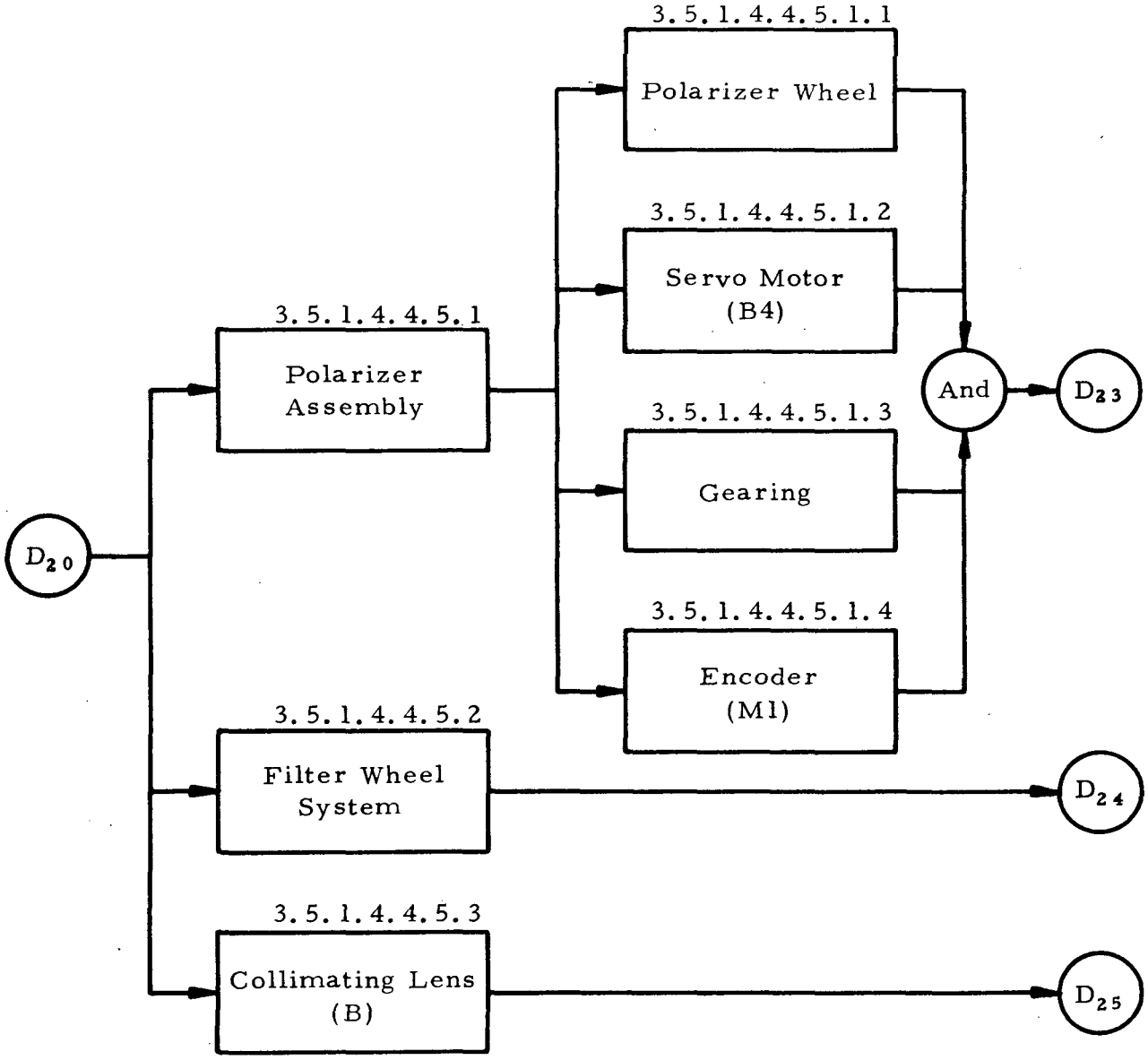


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 11 of 14)

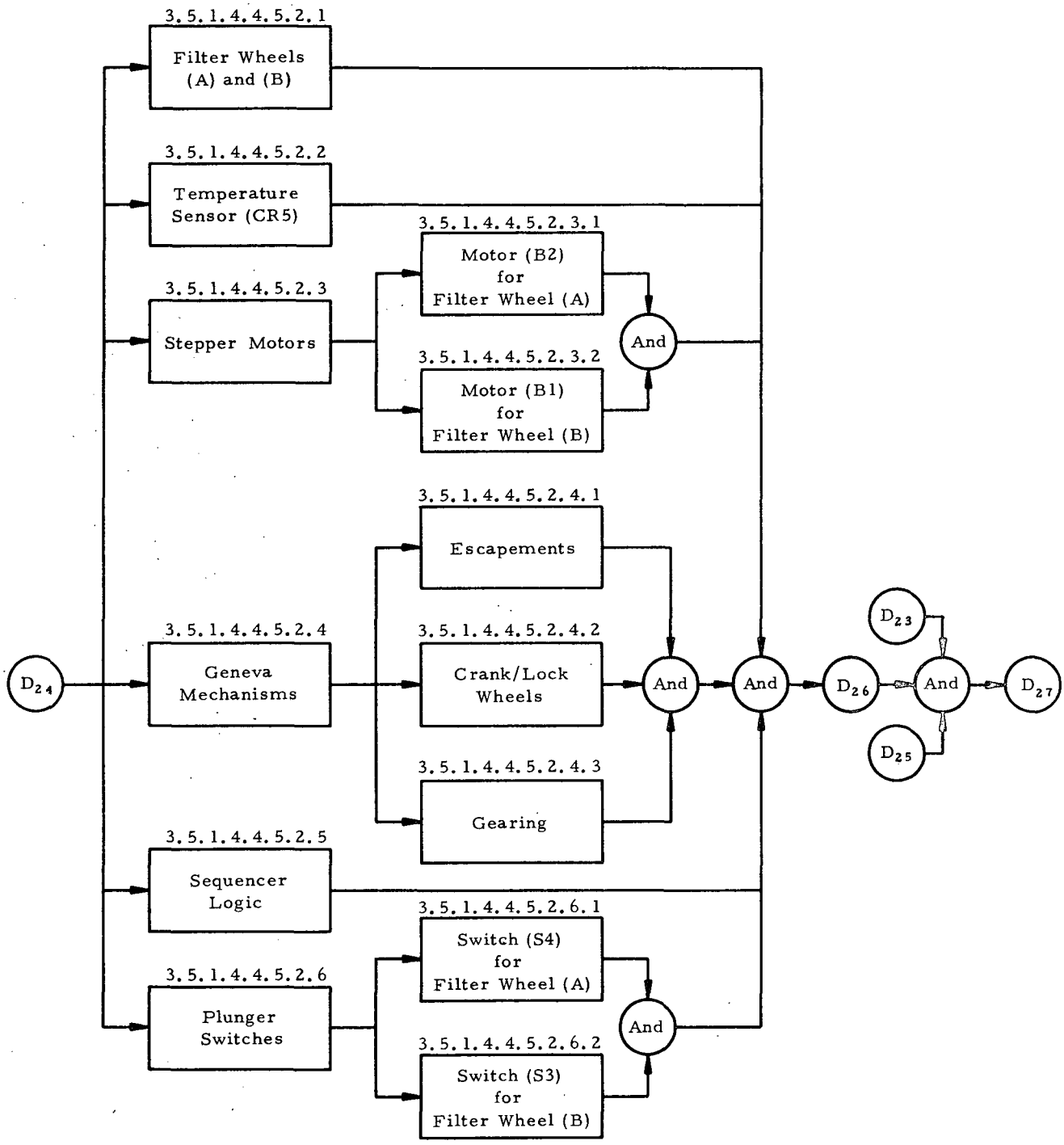


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 12 of 14)

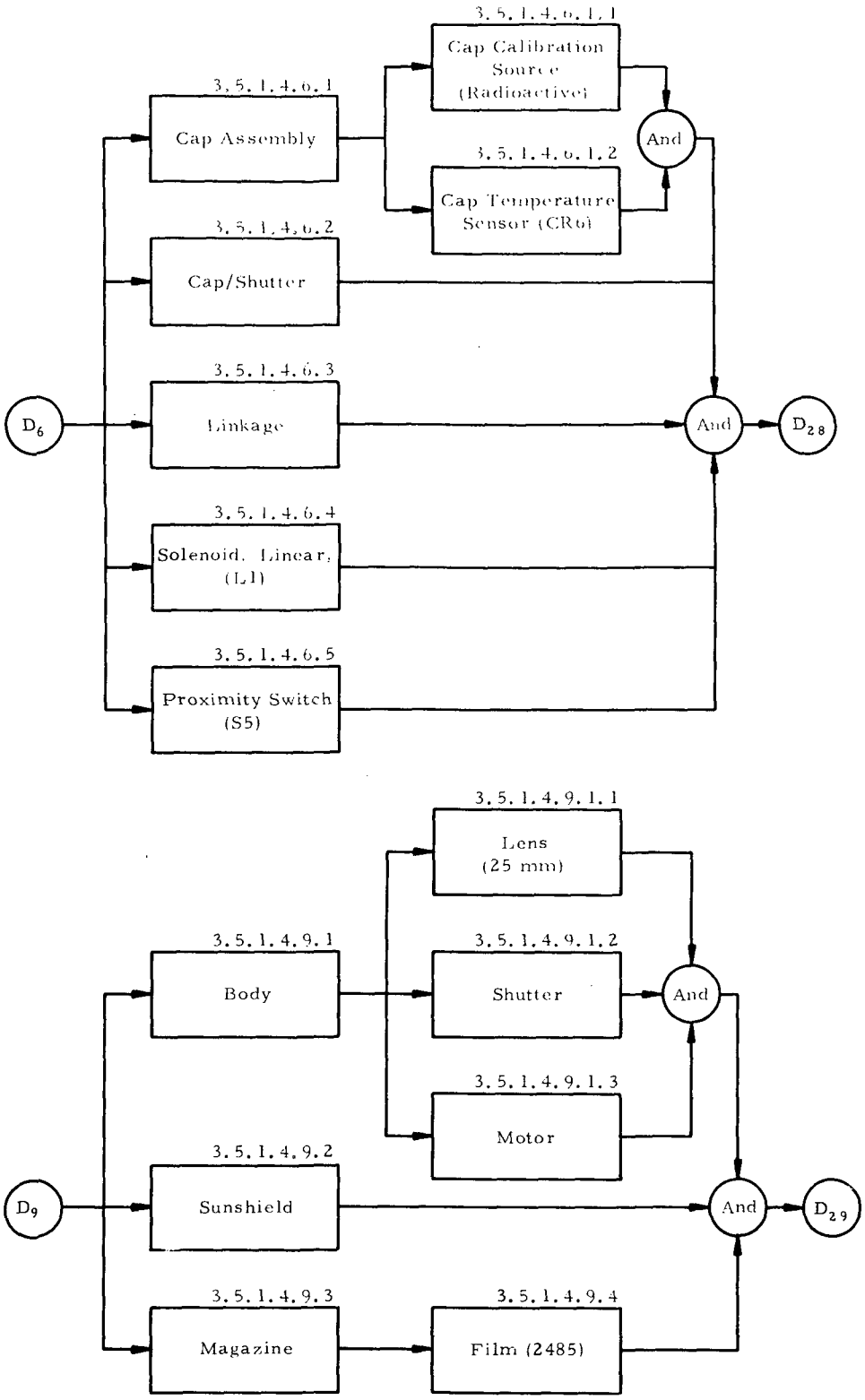


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 13 of 14)

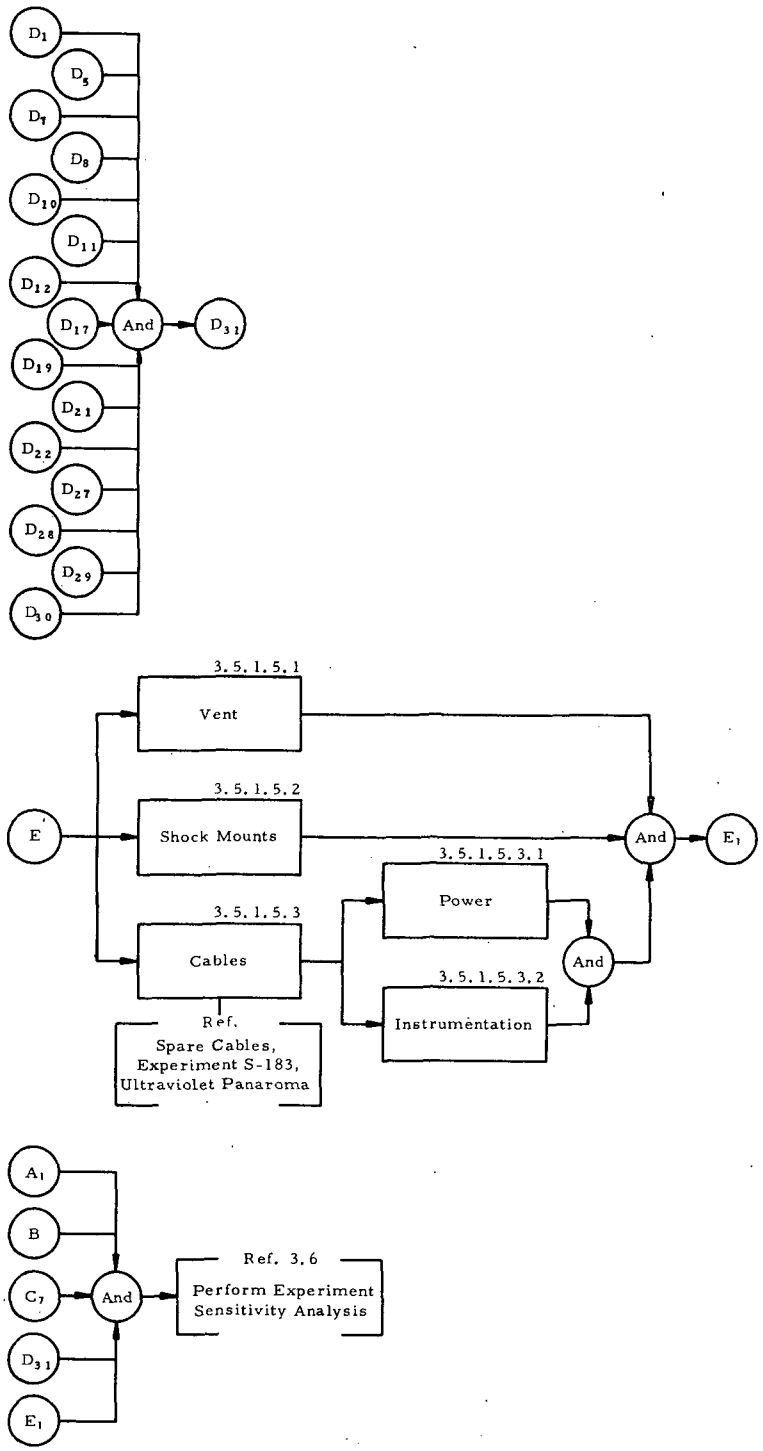
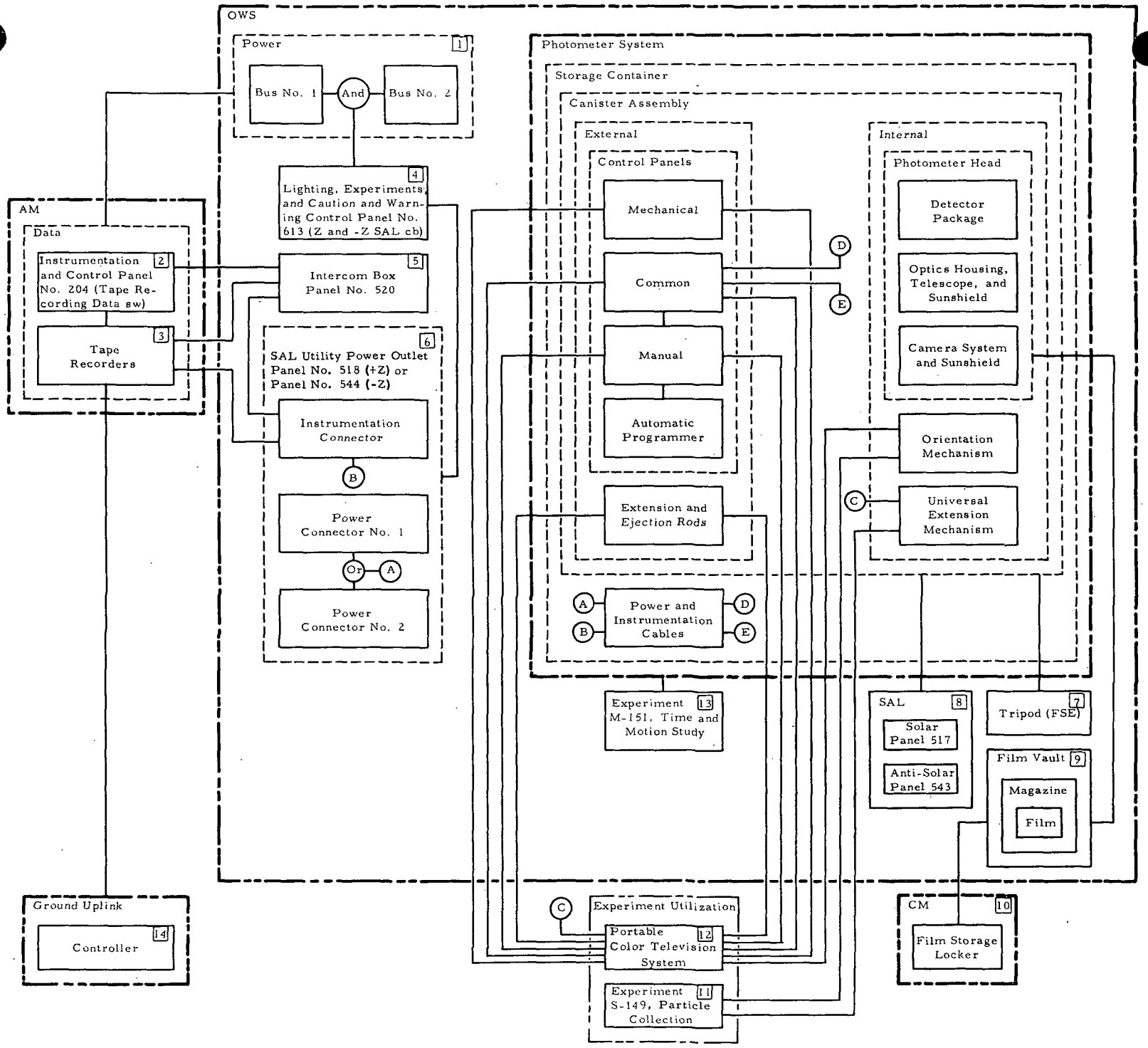


FIGURE T-1. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT FUNCTIONAL BLOCK DIAGRAM (Sheet 14 of 14)

SECTION II.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT INTERFACE BLOCK DIAGRAM



T-107

FIGURE T-2. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT INTERFACE BLOCK DIAGRAM AND DEFINITION (Sheet 1 of 2)

FIGURE T-2. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT INTERFACE BLOCK DIAGRAM AND DEFINITION (Sheet 2 of 2)

Code	Data Source	Remarks
1	M7002-440 M7003-440 M7004-440 M7005-440	There are several electrical interfaces that eventually tie into the experiment. Power is supplied to the experiment from OWS Bus 1 and 2 through OWS panel Nos. 613, 518 (+Z), and 544 (-Z). Power is provided to the AM data system that drives the electronics and recorders. The latter supports information gathering from the experiment through the instrumentation cable.
2 3 and 14	Crew/Controller	There is a data interface between the experiment and the AM Data System. Experiment data may be recorded in all of the three data modes: DATA, EXP 1, and EXP 2. Voice data primarily are on the DATA recorder and the backup is on the EXP 1 recorder mode. The experiment telemetry output is routed through the SAL Utility Panel Nos. 518 or 544 to the AM Data System. The tape recording DATA switch on panel 204 permits either the astronaut or the ground controller to operate the tape recorder (CMD position permits ground control, and RECORD position permits astronaut manual control).
4	Crew M7002-440 M7003-440 M7004-440 M7005-440	There is an electrical interface between Experiment T-027/S-073 and each of the following: Lighting, Experiments, and Caution and Warning Control Panel No. 613. This panel contains the cb's that control the power from the AM buses to the SAL Utility Panel Nos. 518 and 544.
5	Crew	There is a communications and data interface between the experiment and intercom panel No. 520 (+Z) or panel No. 540 (-Z). The crew member uses this intercom panel to announce and record experiment actuation time, date of operation, and other comments concerning the performance of the experiment. Voice information is recorded on the AM recorders using the DATA recorder mode.
6	Crew M7002-440 M7003-440 M7004-440 M7005-440	There is an electrical and data interface between the experiment and SAL Utility Panel Nos. 518 and 544. The experiment power and telemetry cables are attached to the power and instrumentation connectors on the selected SAL utility panel. Power connectors Nos. 1 and 2 are receptacles for OWS Bus 1 and 2, respectively.
7	Crew	There is a mechanical interface between the tripod and the canister assembly. The tripod provides additional support and rigidity to the canister assembly when it is attached to an SAL.
8	Crew	There is a mechanical and environmental interface between the +Z and -Z SAL's. The canister assembly is attached to an SAL by the crew members. Once the SAL outer doors are opened, the internal portion of the canister that houses the photometer head is exposed to a space vacuum.
9 10	Crew	There is a mechanical and environmental interface between the film and the camera system and the film and the CM. Experiment T-027/S-073 will use three 140-ft film magazines with Kodak type 2485 film for each mission. The film will be loaded in the Mauer camera located on the photometer head assembly. Environmental protection for the film during storage periods is provided by the film vault. The film will be returned in the film locker aboard the CM. Radiation exposure during experiment operation and storage is expected to result in significant film degradation. The experiment developers have been apprised of this; nevertheless, they expect that the film will be of usable quality for their objectives.
11	Crew Reference S-149 telemetry	There is an operability interface between Experiment S-149 and each of the following: mechanical control panel, UXM/orientation mechanism, and extension rods. The S-149 experiment cassette is deployed through the mechanical control panel using the above experiment. There is an electrical interface between Experiment S-149 and the common control panel. The common control panel provides power and telemetry connections for S-149. There is a control and instrumentation and data interface between the manual control panel and S-149. The manual control panel selects the experiment (S-149 or T-027/S-073) and activates the motor drive for the MD/CSU. There is a mechanical interface between Experiment S-149 and the orientation mechanism. The MD/CSU is locked into the orientation mechanism for deployment through the SAL.
12	Crew PCTV signal	There are mechanical and operability interfaces between the PCTVS and the orientation and UXM's. The PCTVS also has mechanical, electrical, and pointing and control interfaces with the mechanical, common, and manual control panels, respectively (see code 10).
13	Crew	Experiment M-151, Time and Motion Study, will film one sequence each of the crewman attaching the canister assembly to and removal from each SAL.

SECTION III.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT SYSTEMS DIAGRAM

Note: Taken from Reference 37.

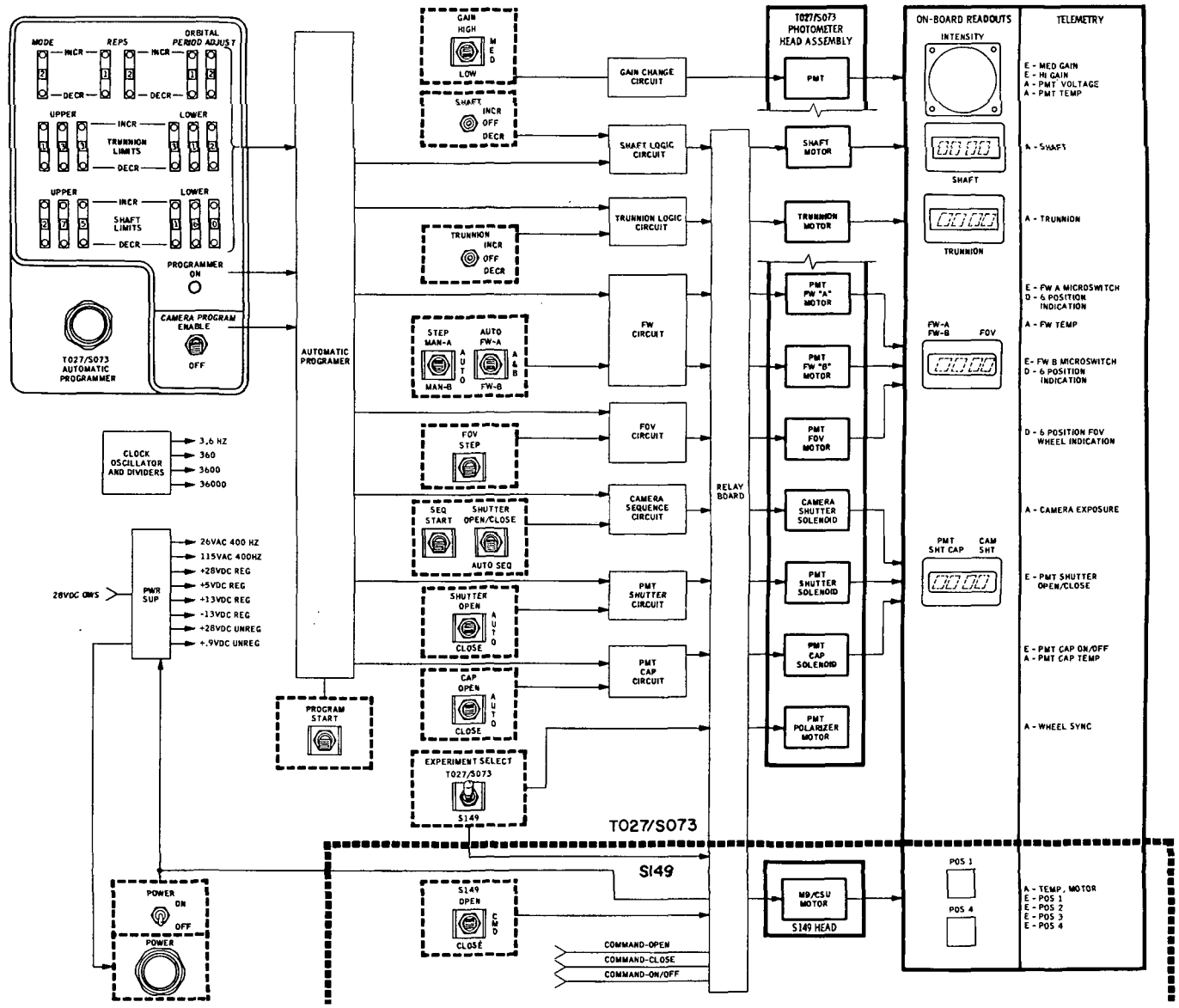


FIGURE T-3. EXPERIMENT T-027 / S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT SYSTEMS DIAGRAM (Sheet 1 of 5)

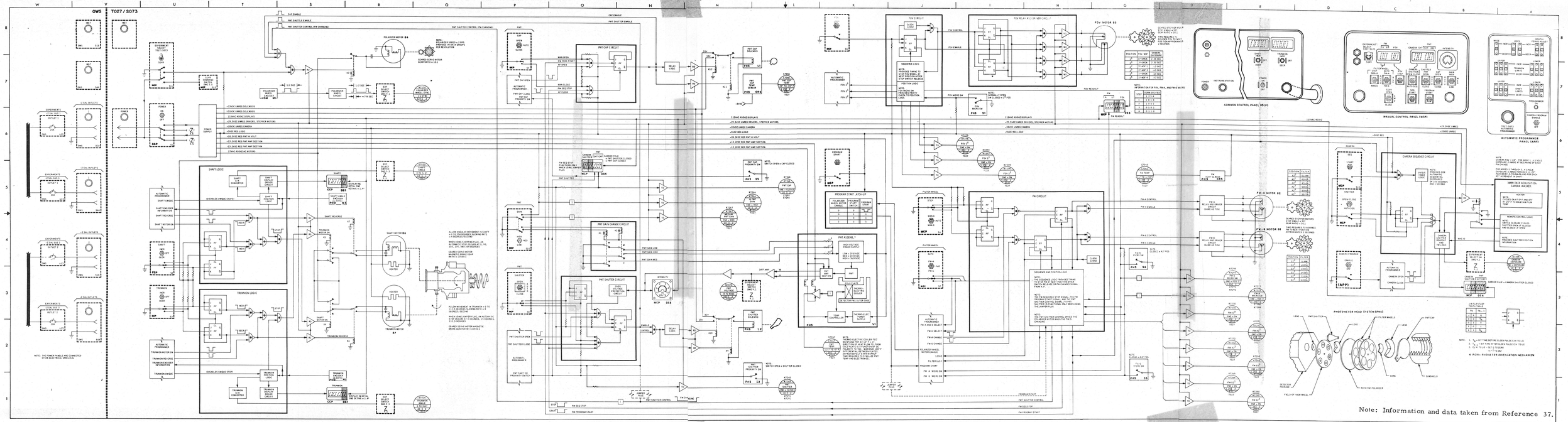
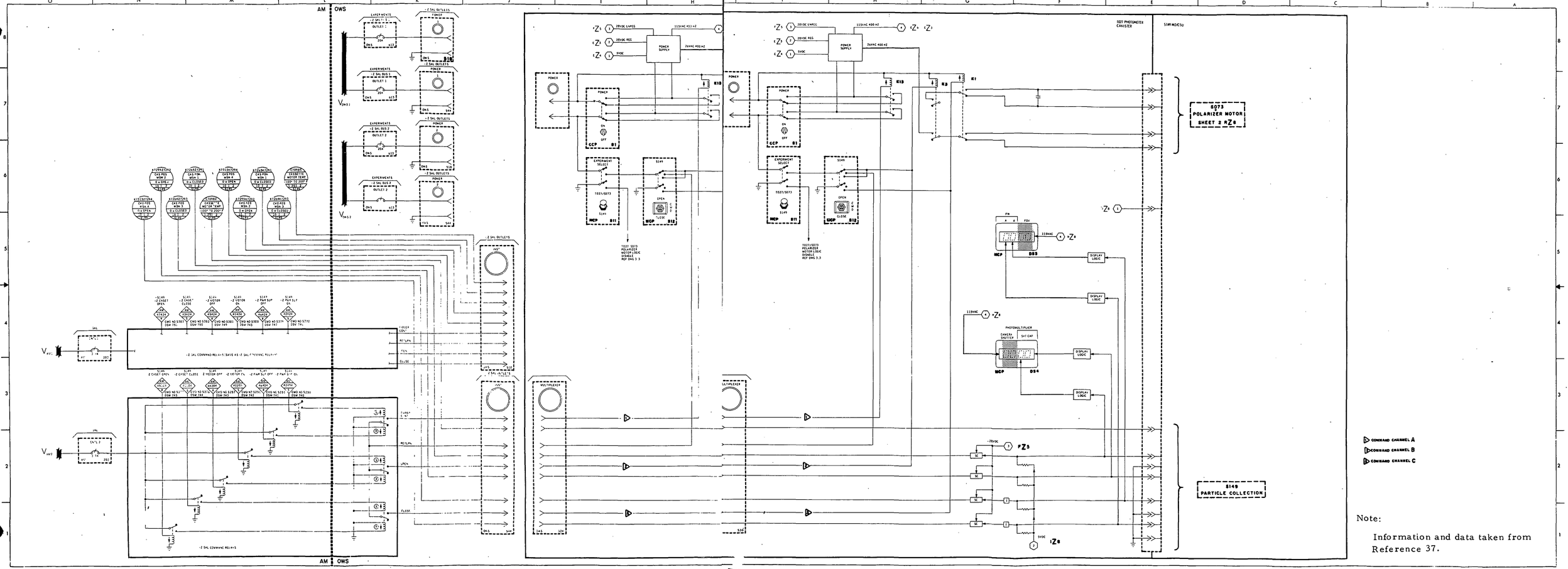


FIGURE T-3. EXPERIMENT T-027 / S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT SYSTEMS DIAGRAM (Sheet 2 of 5)

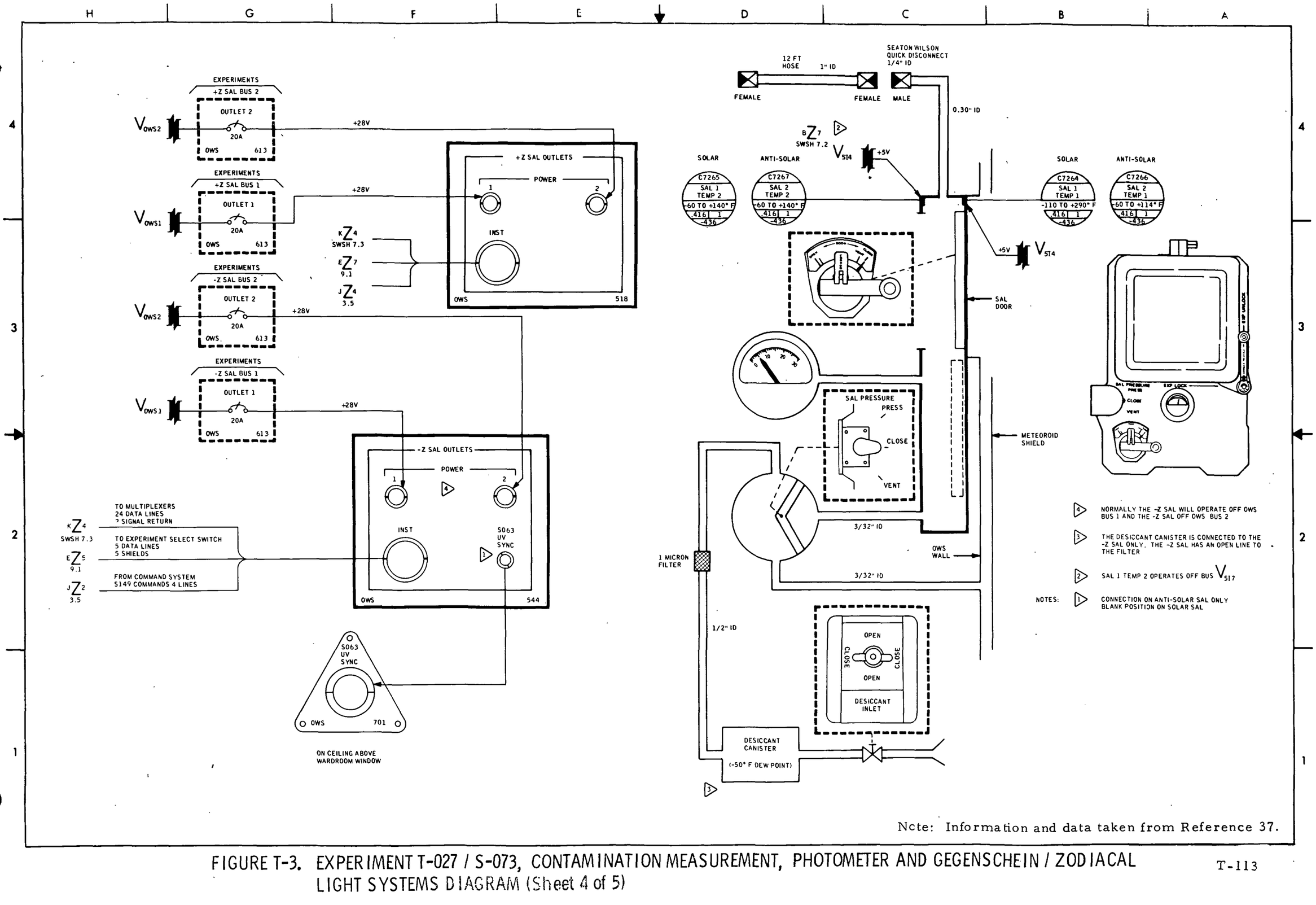


Note:

Information and data taken from Reference 37.

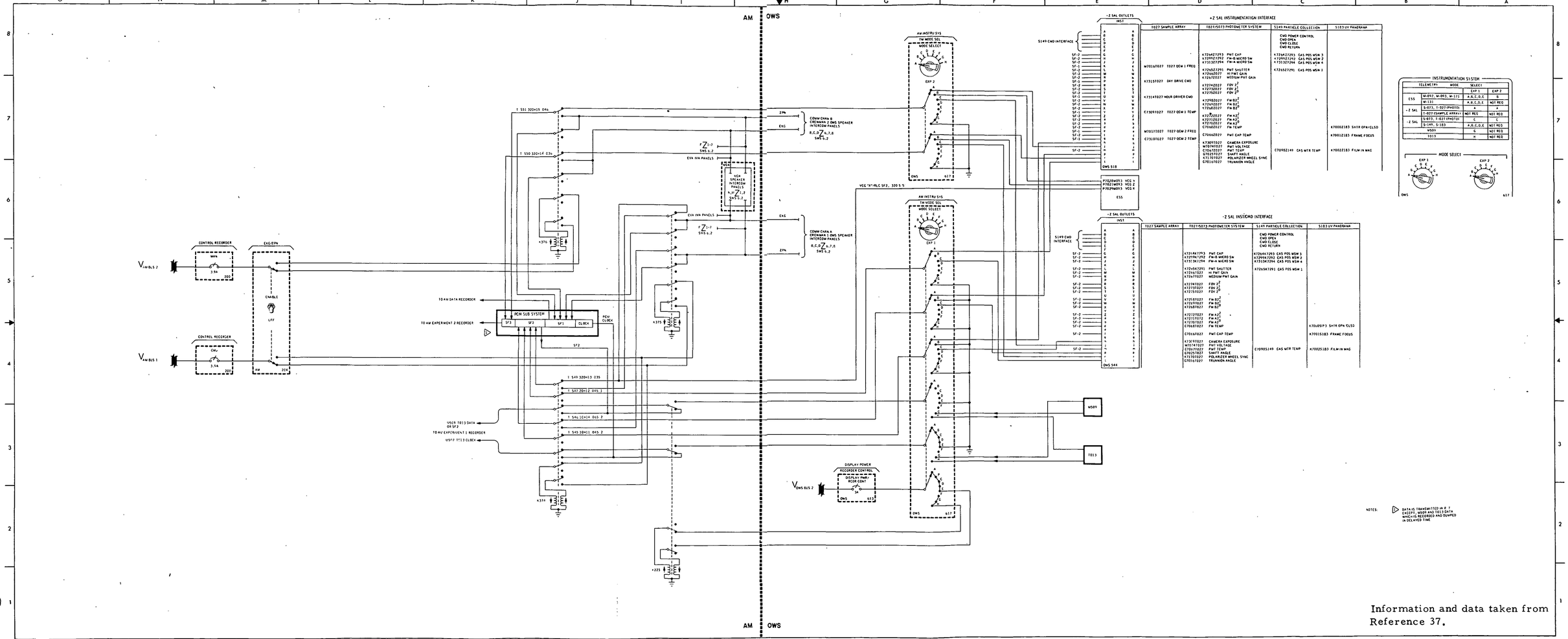
FIGURE T-3. EXPERIMENT T-027 / S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT SYSTEMS DIAGRAM (Sheet 3 of 5)

T-027 / S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT SYSTEMS DIAGRAM (Sheet 3 of 5)



Ncte: Information and data taken from Reference 37.

FIGURE T-3. EXPERIMENT T-027 / S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT SYSTEMS DIAGRAM (Sheet 4 of 5)



Information and data taken from Reference 37.

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODICAL LIGHT SYSTEMS DIAGRAM (Sheet 5 of 5)

SECTION IV.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT DATA REQUIREMENTS SUMMARY

TABLE T-11. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT
DATA REQUIREMENTS SUMMARY (Sheet 1 of 2)

Measurement Name	Range and Dimension of Variable	Measurement Number	Telemetry Assignment Channel	Data Return	Data Time	Remarks
Voltage - Exp T027, Phomult Tube Output	0 to 5 Vdc	M7074T027	WP1H046A01H141	Analog	Near/All	On-board recording time shared with M046-527 and P7028M093 are switchable in AM. Analog 5 Vdc = ON (for both SAL's). Previously referred to as Cur-Exp T-027, PMT.
Event - Exp T027, Pol Wheel Sync	0 or 5 Vdc	K7170T027	WP1H036A01H142	Analog	Near/All	On-board recording time shared with M046-527 and P7021M093 are switchable in AM. Analog 5 Vdc = ON (for both SAL's).
Event - Exp T027, Phomult Tube Cap	0 or 32 Vdc	K7264Z7293 K7264K7293	WP1C025B02BK01 WP1C025I03BK16	Event	Near/All	SAL No. 1, on-board recording time shared with K7293Z7264, ONE = ON. SAL No. 2, on-board recording time shared with K7293K7264, ONE = ON.
Event - Exp T027, FW A Blk MSW	0 or 32 Vdc	K7313Z7294 K7313K7294	WP1C025D02BK03 WP1C025C04BK18	Event	Near/All	SAL No. 1, on-board recording time shared with K7394Z7213, ONE = ON. SAL No. 2, on-board recording time shared with K7394K7213, ONE = ON.
Event - Exp T027, FW A 2**0	0 or 32 Vdc	K7270Z027 K7270T027	WP1C045I04PJ40 WP1C045F04PJ37	Event	Near/All	SAL No. 1, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc. SAL No. 2, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc.
Event - Exp T027, FW A 2**1	0 or 32 Vdc	K7271Z027 K7271T027	WP1C045H04PJ39 WP1C065I04PK40	Event	Near/All	SAL No. 1, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc. SAL No. 2, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc.
Event - Exp T027, FW A 2**2	0 or 32 Vdc	K7272Z027 K7272T027	WP1C045G04PJ38 WP1C065H04PK39	Event	Near/All	SAL No. 1, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc. SAL No. 2, on-board recording, ONE = OFF. Pulse bi-level, 0 to 5 Vdc.
Event - Exp T027, Phomult Tube SH	0 or 32 Vdc	K7265Z7291 K7265K7291	WP1C025E02BK04 WP1C025D04BK19	Event	Near/All	SAL No. 1, on-board recording time shared with K7291Z7265, ONE = ON. SAL No. 2, on-board recording time shared with K7291K7265, ONE = ON.
Event - Exp T027, FW B Blk MSW	0 or 32 Vdc	K7299Z7292 K7299K7292	WP1C025C02BK02 WP1C025B04BK17	Event	Near/All	SAL No. 1, on-board recording time shared with K7292Z7299, ONE = ON. SAL No. 2, on-board recording time shared with K7292K7299, ONE = ON.
Event - Exp T027, FW B 2**0	0 or 32 Vdc	K7268Z027 K7268T027	WP1C025E03BK12 WP1C025H03BK15	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T027, FW B 2**1	0 or 32 Vdc	K7269Z027 K7269T027	WP1C025D03BK11 WP1C025G03BK14	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T027, FW B 2**2	0 or 32 Vdc	K7298Z027 K7298T027	WP1C025C03BK10 WP1C025F03BK13	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T027, Phomult Tube H/G	0 or 32 Vdc	K7266Z027 K7266T027	WP1C025F02BK05 WP1C025E04BK20	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.

TABLE T-II. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT DATA REQUIREMENTS SUMMARY (Sheet 2 of 2)

Measurement Name	Range and Dimension of Variable	Measurement Number	Telemetry Assignment Channel	Data Return	Data Time	Remarks
Event - Exp T027, Phomult Tube M/G	0 or 32 Vdc	K7267Z027 K7267T027	WP1C025G02BK06 WP1C025F04BK21	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T207, FOV Wheel 2**0	0 or 32 Vdc	K7275Z027 K7275T027	WP1C025B03BK09 WP1C025I04BK24	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T027, FOV Wheel 2**1	0 or 32 Vdc	K7273Z027 K7273T027	WP1C025I02BK08 WP1C025H04BK23	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Event - Exp T027, FOV Wheel 2**2	0 or 32 Vdc	K7274Z027 K7274T027	WP1C025H02BK07 WP1C025G04BK22	Event	Near/All	SAL No. 1, on-board recording, ONE = ON. SAL No. 2, on-board recording, ONE = ON.
Temp - Exp T027, Phomult Tube	100 to -25 °F	C7067Z027 C7067T027	WP1B105A22HK54 WP1B105A08HK66	Analog	Near/All	SAL No. 1, on-board recording time shared with C7098Z149 and K7002Z183. SAL No. 2, on-board recording time shared with C7098S149 and K7002S183.
Temp - Exp T027, Cal Source	160 to -50 °F	C7066Z027 C7066T027	WP1B105A18HK53 WP1B105A04HK65	Analog	Near/All	SAL No. 1, on-board recording time shared with K7001Z183. SAL No. 2, on-board recording time shared with K7001S183.
Temp - Exp T027, Filter Wheel	160 to -50 °F	C7068Z027 C7068T027	WP1B105A14HK52 WP1B105A31HK64	Analog	Near/All	SAL No. 1, on-board recording time shared with K7000Z183. SAL No. 2, on-board recording time shared with K7000S183.
Posit - Exp T027, Shaft Info	0 to 360°	G7025T027	WP1C065A02H144	Analog	Near/All	On-board recording for SAL No. 1 and 2.
Posit - Exp T027, Trunnion Info	0 to 360°	G7016T027	WP1O045A01H143	Analog	Near/All	On-board recording for SAL No. 1 and 2. Only 0 to 112.5° are actually used.
Event - Exp T027, Camera Exposure	0 or 5 Vdc	K7309T027	WP1C045A02HI45	Analog	Near/All	On-board recording analog 5 Vdc = ON (for both SAL's). Requested signal sense at > 3.5 Vdc.
Volt - PDCS, OWS Bus 1	0 to 35 Vdc	M7002-440	WP1B050A21LH05	Housekeeping	Near/All	Signal sense ON when < 24 and > 30 Vdc.
Volt - PDCS, OWS Bus 2	0 to 35 Vdc	M7003-440	WP1B010A21LH05	Housekeeping	Near/All	Signal sense ON when < 24 and > 30 Vdc.
Cur - PDCS, OWS Bus 1	0 to 140 A	M7004-440	WP1B074A09HE43	Housekeeping	Near/All	
Cur - PDCS, OWS Bus 2	0 to 140 A	M7005-440	WP1B034A01HD41	Housekeeping	Near/All	
Voltage - Instru Bus A + 5 Vdc	0 to 6.5 Vdc	M513-514	WP1H114A01LC08	Housekeeping	Near/All	
Voltage - Instru Bus B +5 Vdc	0 to 6.5 Vdc	M522-514	WP1B139A30LT08	Housekeeping	Near/All	
Event Elapsed Time (Coarse)	LSB = 1/8 sec 24 bit word	K502-512	WP1A124A04D107 WP1A045A03D107 WP1A046A03D107 WP1A049A03D107	Event	Near/All	

SECTION V.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT DATA REQUEST FORMS

Data Request Forms (DRF's) have been submitted to HOSC for processing. The DRF's are not presented herein at the request of the Laboratory representative.

SECTION VI.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT ENGINEERING CHANGE REQUESTS

Engineering Change Requests for Experiment T-027/S-073 are N/A.

SECTION VII.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT EVALUATION SEQUENCE

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 1 of 33)

Assignments

Mission:

- SL-1/SL-2, SL-3 and SL-4

Orbital Assembly:

- OWS

Carrier:

- The Photometer system is stored near Position I at OWS Sta. No. 437.997 (stowage container F591).
- The experiment is performed through the solar (+Z) or anti-solar (-Z) SAL's at OWS Sta. No. = 467.997. Both SAL's will be used during each mission.

Conditions

Crew:

- Any combination of the Commander (CDR), Science Pilot (SPT), or Pilot (PLT) can be used to set up, operate, and stow the experiment hardware. Two crewmen are required to set up and stow the hardware while one crewman can operate the experiment.
- On some photometer scans, a crew member will be required to monitor experiment operation, select trunnion and shaft positions, and reset control panel switching as necessary.
- All photometer calibration, scan, and stowage operations require a crew member to set up and start the automatic programmer. (References 38 and 39).

Experiment:

- The photometer setup, operation, and stowage times for each mission are expected to vary and will be updated by the PI and recorded in Reference 3.

Flight Support:

- The tripod is stowed between the OWS wall and stowage location F596.

Ground Support:

- The Ground Controller may interrogate the AM data recording tape for photometer system performance data. A telemetry link can be established if the Operator (OPR) sets up the AM recording panel switching.

Requirements

Functional Objectives:

SL-1/SL-2

- FO-1 through FO-4: Perform System Monitor Program 0
- FO-5 through FO-10: Perform Contamination Programs 1a (FO-5 through FO-8), 3b (FO-9), 3d (FO-10)
- FO-11 and FO-12: Perform in Ecliptic Programs 2a (FO-11) and 2b (FO-12)
- FO-13 and FO-14: Perform Vertical Circle Programs 2c (FO-13) and 2d (FO-14)
- FO-15 and FO-16: Perform All Sky Map Programs 5a (FO-15) and 5b (FO-16)
- FO-17 and FO-18: Perform Celestial Poles (N and S) Program 1e
- FO-19 and FO-20: Perform Gegenschein Programs 1b (FO-19) and 4a (FO-20)
- FO-21: Perform Perpendicular to Ecliptic Program 3a
- FO-22: Perform Inner Zodiacal Light/Contamination Program 4b
- FO-23: Perform Ecliptic Pole (N) Program 1d

SL-3 and SL-4

- Refer to SEPEM, Appendix T, Table T-I, Functional Item 3.1.2.

Experiment Evaluation Team - Key Personnel Locator

Name	Responsibility	Office Address, Symbol, and Telephone Number (Business and Home)
Mr. W. R. Bock	Technical Discipline Manager (TDM)	MSFC, Bldg. 4610, S&E-ASTN-SDF, 205 453-3810 205 881-4419
Mr. C. Brown	Experiment Developer (ED)	Martin Marietta Corporation, Denver, Colorado, 303 794-5211, Ext. 5458 303 279-6859 205 881-5381
Mr. J. Carbo	Design Specialist, Mechanical (DSM)	Martin Marietta Corporation, Denver, Colorado, 303 794-5211, Ext. 3730 303 798-1263 205 881-5381
Mr. W. A. Clarke	Integration Engineer (IE)	MSFC, Bldg. 4610, S&E-ASTN-SDI, 205 453-3811 205 881-7604
Mr. H. Cornett	Crew Operations Specialist (COS)	Martin Marietta Corporation, Houston, Texas, 713 333-4150, Ext. 234
Mr. P. Craven	Science Representative (SR)	MSFC, Bldg. 4481, S&E-SSL-TT, 205 453-3103 205 852-0117
Mr. G. Cress	Flight Controller (FC)	MSC, Bldg. 30, FC6, 713 483-4717
Mr. C. DeSanctis	Mission Support Group Leader, Corollary Experiments (MSG)	MSFC, Bldg. 4201, SL-EI, 205 453-1656 205 881-1315
Mr. V. Fogel	Experiment Manager (EM)	MSFC, Bldg. 4201, PM-SL-DP, 205 453-3182 205 837-2267
Mr. L. Fredrick	SAL/EREP Experiment Team Leader (ETL)	MSFC, Bldg. 4201, SL-EI, 205 453-1656 205 323-2433
Mr. M. Fry	Design Specialist, Electrical (DSE)	Martin Marietta Corporation, Denver, Colorado, 303 794-5211, Ext. 3790 303 237-8743 205 881-5361
Dr. A. Gary	Science Representative (SR)	MSFC, Bldg. 4481, S&E-SSL-TT, 205 453-3103 205 883-2552
Mr. E. Hafen	Operations Support Specialist (OSS)	Martin Marietta Corporation, Denver Colorado, 303 794-5211, Ext. 3790 205 881-5381
Mr. J. Kierein	Experiment Integration Engineer (EIE)	Martin Marietta Corporation, Denver, Colorado, 303 794-5211, Ext. 4538 303 798-4914
Mr. J. E. Meyers	Experiment Operations Engineer (EOE)	Teledyne Brown Engineering Company, Huntsville, Alabama, 205 532-1612 205 881-9176
Dr. J. Muscari	Principal Investigator (PI), T-027, Contamination Measurement, Photometer	Martin Marietta Corporation, Denver, Colorado, 303 794-2859, Ext. 2381
Mr. A. Ousley	Experiment Integration Manager (EIM)	MSFC, Bldg. 4200, S&E-R-F, 205 453-1123 205 539-3222
Mr. J. Reaves	Crew Systems (CS)	MSFC, Bldg. 4612, S&E-ASTN-SMS, 205 453-4375 205 883-2796
Mr. J. Reavis	Qual/Test Representative (QTR)	MSFC, Bldg. 4707, S&E-QUAL-ATE, 205 453-4660 205 852-2635
Mr. W. Teague	Experiment Operations Specialist (EOS)	MSC, Bldg. 4, CG3, 713 483-3048 or 3091
Dr. J. L. Weinberg	Principal Investigator (PI), S-073, Gegenschein/Zodiacal Light	Dudley Observatory, Albany, New York, 518 459-4750

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 2 of 83)

Operation Step Number*	Data: Return: Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
P minus 90 min. MD/DOY for SL-1/SL-2: 9/143 at 1810 GMT (1310 CDST) MD/DOY for SL-3: MD/DOY for SL-4:	Experiment Evaluation Team manned and available: • HOSC Control, Mr. W. R. Bock (TDM), Bldg. 4463, telephone exchanges: MSFC: N/A; PABX: 240, 311; LIEF: 41, 56 • Experiment Integration Operations, Mr. W. A. Clarke (IE), Bldg. 4619, telephone exchanges: MSFC: Not Available; PABX: N/A; LIEF: N/A • SAL/EREP Experiment Support, Mr. L. Frederick (ETL), Bldg, 4471, telephone exchanges: MSFC: 205-453-0595; PABX: 353, 355; LIEF: N/A, N/A References: • Skylab Flight Plan, SL-1/SL-2, SL-3, and SL-4, Summary and Detail Timelines, MSC, latest revision. • SAL/Experiments Checklists, SLM-1, SLM-2, and SLM-3, Crew Procedures, MSC, latest revision. • Instrumentation Program and Components List, OWS, 1B68467, latest revision. • S&E-ASTN's Instrumentation Requirements, S&E-ASTN-SD, latest revision.											PABX Operator, 453-2200 LIEF Operator, 453-4100
P minus 60 min SL-1/SL-2: 1840 GMT (1340 CDST) SL-3:	Commence experiment preparation (ground action):											

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D - Discrete (Specified number of times)

****R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 3 of 83)

Operation Step Number*	Data: Return: Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Anomaly	Remarks****	See Contingency Plan Number	Contingencies: Remarks
SL-4:												
P 1.0	Determine carrier/experiment support instrumentation status.											
P 1.1	Acquire status and evaluate the performance of the following measurements.											
P 1.1.1	TBS	Volt - PDCS, OWS Bus No. 1 M7002-440	WP1B050A21LH05	H	C	Range: 0 to 35 Vdc Read: 24 to 30 Vdc	21 to 33 Vdc			Ā and N		Voltage must not go below or exceed the upper and lower limits of the steady state voltage of 28 $^{+2}_{-4}$ V by more than 3 V and must return to the steady state condition within 1 sec. A voltage transient of 35 V is acceptable if the voltage returns to the steady state condition within 0.1 sec.
P 1.1.2	TBS	Volt - PDCS, OWS Bus No. 2 M7003-440	WP1B010A21LH05	H	C	Range: 0 to 35 Vdc Read: 24 to 30 Vdc	21 to 33 Vdc			Ā and N		
P 1.1.3	TBS	Cur - PDCS, OWS Bus No. 1 M7004-440	WP1B074A09HE43	H	C	Range: 0 to 140 A Read:	13 to 46 A			Ā and N		
P 1.1.4	TBS	Cur - PDCS, OWS Bus No. 2 M7005-440	WP1B034A01HD41	H	C	Range: 0 to 140A Read:	13 to 46 A			Ā and N		

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 4 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P = 0.0 min SL-1/SL-2: 1940 GMT (1440 CDST) SL-3: SL-4:	Commence experiment preparation (flight action):					
P 2.0	OPR	Unstow, check out, set up, and prepare experiment for operation.				
P 2.1		Set up Experiment M-151 DAC preparation (if required): Anti-Solar SAL, (-Z) • DAC 06/5mm/F1.8/1/60/inf/6fps • Universal mount x = 000, y = 30, z = 208 • Remote control cable to +Z SAL • Film cassette/mag., M-151 PHOTO PAD • Hi intensity light aim at M-509/F593 • Connect power cable to 541-6. Solar SAL, (+Z) • DAC 04/10mm/f2/1/60/inf/6fps • Universal mount x = 340, y = 120, z = 318 • Remote control cable to +Z SAL • Film cassette/mag., M-151 PHOTO PAD • Hi intensity light aim at F591 • Connect power cable to 541-6.				This task is only accomplished two times; one time each for experiment/SAL equipment setup. DAC stowage: F8 Light stowage: F9/F6 DAC stowage: F7
P 2.2		Obtain and stow the experiment's logbook near the appropriate SAL.				Logbook stowage: W742

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 5 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 2.2 (Concluded)		Note: If the photometer system is to be operated immediately after installation and no instrumentation conflict exists with other experiments (Panel 617), perform Operation Step No. P 2.3.				
P 2.3		Configure panel 617 for T-027/S-073 experiments using decal: • Mode Select Exp 1 sel - Channel A or C. • Mode Select Exp 2 sel - Channel A or C.				Panel No. 617 located at OA crew station E, OWS experiments. Channel A for +Z SAL Channel C for -Z SAL
P 2.4		For Experiment M-151 operation (if required): • Hi intensity lt SYS 1 & 2 HIGH POWER - ON (3 min warm up required) • DAC pb - on.				
P 2.5	TP and PLT	Remove photometer system and restrain on top of stowage container lid. Note: Lift canister assembly evenly and straight out otherwise the guide cones may bind. Caution Remove the end plate from the canister straight out so as not to bind the photometer sun shield alignment cones.			P25A1 through P25D1	Photometer stowage location: F591. Two crewmen required. Three Calfax launch fasteners (END PLATE end) mate with receptacles on the F591 lid to restrain the photometer system. The END PLATE end of the canister should be pointing towards SAL 1.
P 2.6		Remove front end plate from canister assembly and attach to T027 END PLATE STOWAGE PS stowage location.			P26A1 through P26B1	END PLATE stowage location: F591.

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 6 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satisfactory	Anomaly		
P 2.7		Release tube brake from launch plug on mechanical control panel and detent open.			P27A1 and P27A2	Crew Checklist refers to rod brake in lieu of tube brake.
P 2.8		Unscrew, remove, and dispose launch plug.			P28A1 through P28B2	
P 2.9		Remove extension rod handle from top of photometer canister and attach to extension rod A.				
P 2.10		Remove extension rod A from rack (rotate ccw), align, and partially thread to photometer system extension mechanism.			P210A1 through P210C1	Latch blocks the pins on the end of the extension rod from being fully engaged.
P 2.11		Press and lock mechanical control panel rod LATCH in open position. Caution Do not over torque extension rods. Ensure a firm and snug fit between rod and extension mechanism interface.			P211A1 through P211C2	
P 2.12		Complete threading of extension rod A to photometer system extension mechanism.			P212A1 through P212J2	
P 2.13		Deploy photometer system head out of the canister until handle is approx. 5 in. from mechanical panel.			P213A1 through P213B5	
P 2.14		Clamp tube brake to rod A.			P214A1 and P214A2	
P 2.15		Verify that the three orientation mechanism locks are in the locked positions.				Two trunnion locks and one shaft lock.
P 2.16		Obtain film magazine from OWS film vault (See T-027/S-073 UPDATE pad).				Film stowage location: F510. Magazine / Location BV01 / F17 BV02 / F18 BV03 / F19
P 2.17		Remove dummy film magazine from photometer head camera for disposal.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 7 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 2.18		Install film magazine on photometer head camera.				
P 2.19		Verify DAC settings:				DAC settings are not to be changed unless the PI's and the PAD so directs.
P 2.19.1		Focus -- ∞				
P 2.19.2		f Stop -- 0.95				
P 2.19.3		Shutter Speed -- 1/60				
P 2.19.4		Exposure -- Time				
P 2.20		Remove photometer head forward SUNSHIELD COVER and attach to T027 PS DUST COVER STOWAGE bracket.			P220A1 and P220B1	SUNSHIELD COVER stowage location: F591.
P 2.21		For usage on the (+Z) SAL: proceed to Operation Step No. P 2.25.				
P 2.22		For usage on (-Z) SAL: remove forward sunshield segment and installed aft SUNSHIELD COVERS on sunshield segment.			P222A1 and P222B1	Obtain aft SUNSHIELD COVERS from canister mounts located on the control panel side of the photometer.
P 2.23		Reinstall photometer head forward SUNSHIELD COVER or sunshield segment.				
P 2.24		Restrain capped sunshield assembly on top of Sample Array stowage container using straps.				Sample Array stowage container (T-027) stowage location: F590.
P 2.25		Verify that photometer head attaching screws (two knurled knobs) are tight and positively latched (latch retained in locking groove).			P225A1	
P 2.26		Verify gear alignment of FW's.			P226A1 through P226B2	Align either index mark on the excapement to the motors.
P 2.27		Rotate the three orientation mechanism locks to the unlocked position.			P227A1 through P227C1	All locks rotate normal to the Z axis to open.
P 2.28		Verify photometer head electrical connector (61 pins) joined, and cable bundle is looped in the direction of the photometer head. Press and lock rod LATCH open.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 8 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 2.29		Retract the photometer head into the canister until extension rod A full retraction mark is visible. Caution If photometer head hangs up during retraction, determine and correct problem before proceeding.			P229A1 through P229C2	
P 2.30		Maintain constant retraction force on the A rod until the rod LATCH engages.				
P 2.31		Verify rod LATCH is engaged.				
P 2.32		Remove and stow extension rod and extension rod handle.			P232A1 through P232H16	
P 2.33		Obtain tripod legs, head, and assemble unit (if required).			P233A1	Tripod stowage location: Either F596 (assembled), or F569 (disassembled).
P 2.34		Attach tripod to OWS floor at the designated position by turning hand screws. Note: The tripod support bracket retaining screw should be normal to the SAL. The hand screws (3 each) should be configured for tripod floor installation (a gap between the spacer and hand screw should be visible after attachment to the floor).			P234A1 through P234B1	
P 2.35		Position vertical support towards SAL (max. ccw lateral adjustment, center carriage of tripod).				
P 2.36		Remove support bracket from tripod, and reinstall retaining screw and spacer.				Use 3/16 in. Allen bit and spin handle. Stowage location E624, Drawer 1B.
P 2.37		Attach tripod support bracket to T-027 canister assembly (bracket slot towards SAL).			P237A1 and P237A2	The crew may elect to do P 2.37 after P 2.38.
P 2.38		Attach photometer system into SAL (refer to SAL experiment installation procedure decal, two crewmen required).			P238A1 through P238A8	Panel 517 is for +Z SAL and Panel 543 is for -Z SAL.
P 2.39		Adjust tripod support to photometer system (center - no contact), as indicated by procedure decal.				The canister is not seated against the tripod; approximately 3/16-in. clearance is maintained.

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 9 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 2.40	TP	Set up pre-power/verification check of photometer system:				
		Common Control Panel				
P 2.40.1		POWER sw - OFF				S1
P 2.40.2		SHAFT sw - off (center position)				S2
P 2.40.3		TRUNNION sw - off (center position)				S3
		Manual Control Panel				
P 2.40.4		EXPERIMENT SELECT sw - T-027/S-073				S12
P 2.40.5		FILTER WHEEL AUTO sw - A&B				S7
P 2.40.6		PMT GAIN sw - LOW				S10
P 2.40.7		Common-to-Manual Control Panel, connector is attached (verify).				
		Automatic Programmer				
P 2.40.8		CAMERA PROGRAM sw - OFF				
P 2.40.9		Connector cable attached between Automatic Programmer and Manual Control Panel (verify).				
P 2.41		Obtain SAL PWR and SAL INST cables from photometer stowage container.				Cables stowed in cover of F591 (alternate cables of D424).
P 2.42		Connect SAL INST and SAL PWR cables to photometer common control panel and then to SAL INST and SAL POWER 1 (+Z SAL) or 2 (-Z SAL) outlet on OWS panels 518/544 using cable restraints.			P242A1 through P242B4	
P 2.43		Experiment M-151 operation (if required): • Power - OFF (if termination is desired) • Power - ON (if filming is to continue during experiment extension).				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 10 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P = 4.10 min SL-1/SL-2: 2225 GMT (1725 CDST) SL-3: TBD SL-4: TBD		Extend experiment outboard OA:				
P 3.0	TP	Initiate photometer system deployment.				
P 3.1		Experiment M-151 operation (if required): • Power - ON (3 min warmup).				
P 3.2		Attach handle and remove extension rod A from extension rod rack. Note: Rod attachment sequence: 2 rods--A, C 7 rods--A, B (5), C				
P 3.3		Partially thread extension rod A to photometer system extension mechanism.				
P 3.4		Press and lock rod LATCH in open position. Caution Do not over torque extension rods. Ensure a firm and snug fit between rod and extension mechanism interface.				
P 3.5		Complete threading of extension rod A to photometer system extension mechanism.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 11 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.6		Pull tension on rod A and clamp tube brake. Caution The photometer head should be sleeved to octal 020 (22.5°) in trunnion as quickly as possible when extending from SAL 1 (+Z direction). This operation prevents heat damage to the film.				
P 3.7		Open SAL door (see SAL door opening procedure decal). Warning If an extension rod is accidentally push/pulled through the mechanical panel, resulting in an OWS atmosphere leak, immediately remove the tube plug from the top of the canister and insert into the opening. Note: When operating at the +Z (Solar) SAL, the photometer system should be extended while the OA is in the earth's shadow.				
P 3.8		Extend photometer.				
P 3.8.1		SAL 2 (-Z) rod deployment:				Refer to Step No. P 3.8.2 for SAL 1 rod deployment.
P 3.8.1.1		Release tube brake.				Rod handle is approx. 5 in. from panel.
P 3.8.1.2		Push extension rod until bar mark is in front of tube brake.				
P 3.8.1.3		Clamp tube brake.				
P 3.8.1.4		Remove extension rod handle and attach to rod C.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 12 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.8.1.5		Attach rod C to rod A.			P3815A1 through P3815P1	
P 3.8.1.6		Release tube brake.				
P 3.8.1.7		Push extension rod until handle bar mark is in front of tube brake.				
P 3.8.1.8		Clamp tube brake.				
P 3.8.1.9		Remove extension rod handle and attach crank handle to rod C.				
P 3.8.1.10		Release tube brake and detent open.				
P 3.8.1.11		Release rod LATCH.				
P 3.8.1.12		Insert extension rod handle into crank handle and push rod to its full extension.				
P 3.8.1.13		Verify rod LATCH engaged.				
P 3.8.1.14		Stow extension rod handle.				
P 3.8.1.15		Experiment M-151 16mm DAC and high intensity light - off (if required).				Refer to Operation Step No. P 2.43.
P 3.8.1.16		Position T027/S073 POWER sw - ON.				S1 The shaft and trunnion motor patch heaters are operating.
P 3.8.1.17		Verify the following control and displays. If necessary, actuate the indicated switches to obtain indications:				
P 3.8.1.17.1		Common Control Panel				
		SHAFT ind - 040 (octal) TRUNNION ind - 000 (octal)				DS-1 DS-2

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 13 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.8.1.17.2		Manual Control Panel				
		FW A ind - 0 (step MAN A)				DS-3
		FW B ind - 0 (step MAN B)				DS-3
		FOV ind - 0 (step - FOV)				DS-3
		CAMERA SHT ind - bp (CAMERA SHUTTER - OPEN/CLOSE until bp is observed twice)				DS-4
		PMT SHT ind - bp (PMT SHUTTER - CLOSE)				DS-4
		PMT CAP ind - bp (PMT CAP - CLOSE)				DS-4
		INTENSITY ind - reading 0 Vdc				DS-5
						A barber pole (bp or ≡) readout indicates a closed position. A blank gray indicates an open position.
P 3.8.1.17.3		Automatic Programmer				
		CAMERA PROGRAM sw - ENABLE				
		PROGRAMMER ON lt - off.				
P 3.8.1.18		Voice record and write in logbook the time of photometer *extension.*				Time:
P 3.8.2		SAL 1 (+Z) rod deployment.				Refer to Operation *Step No.* P 3.8.1 for SAL 2 rad deployment.
P 3.8.2.1		Release tube brake				
P 3.8.2.2		Push extension rod until bar mark is in front of tube brake.				
P 3.8.2.3		Clamp tube brake				
P 3.8.2.4		Remove extension rod handle and attach to next extension rod.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSC - One Time Form 17-1 (March 1973)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 14 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.8.2.5		Remove rod and attach to previously installed rod.			P3815A1 through P3815P1	
P 3.8.2.6		Release tube brake.				
P 3.8.2.7		Push extension rod until bar mark is in front of tube brake.				
P 3.8.2.8		Clamp tube brake				
P 3.8.2.9		Position T027/S073 POWER sw - ON.				S1
P 3.8.2.10		Drive TRUNNION sw - INCR (until display is octal 020).				S3, DS-2. Octal 020 is 22.5°.
P 3.8.2.11		Position T027/S073 POWER sw - OFF.				
P 3.8.2.12		Repeat Operations Step Nos. P 3.8.2.4 through P 3.8.2.8 until remaining extension rods are installed.			P38212A1	
P 3.8.2.13		Remove extension rod handle and attach crank handle to rod C.				
P 3.8.2.14		Release tube brake and detent open.				
P 3.8.2.15		Release rod LATCH.				
P 3.8.2.16		Insert extension rod handle into crank handle and push rod to its full extension.				
P 3.8.2.17		Stow extension rod handle.				
		Warning Do not stand in front of crank handle when applying or releasing UXM preload.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 15 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.8.2.18		Preload the extension mechanism by rotating crank handle cw until an abrupt tension increase is felt (approx. 37 turns).				
P 3.8.2.19		Experiment M-151 16mm DAC and high intensity light - off (if required).				Refer to Operation Step No. P 2.43.
P 3.8.2.20		Position T027/S073 POWER sw - ON.				S1
P 3.8.2.21		Verify the following control and displays. If necessary, actuate the indicated switches to obtain indications:				
P 3.8.2.21.1		Common Control Panel				
		SHAFT ind - 040 (octal)				DS-1
		TRUNNION ind - 020 (octal)				DS-2
P 3.8.2.21.2		Manual Control Panel				
		FW A ind - 0 (step MAN A)				DS-3
		FW B ind - 0 (step MAN B)				DS-3
		FOV ind - 0 (step - FOV)				DS-3
		CAMERA SHT ind - bp (CAMERA SHUTTER - OPEN/CLOSE until bp is observed twice)				DS-4
		PMT SHT ind - bp (PMT SHUTTER - CLOSE)				DS-4
		PMT CAP ind - bp (PMT CAP - CLOSE)				DS-4
		INTENSITY ind - reading 0 Vdc				DS-5
						A barber pole (bp or) readout indicates a closed position. A blank gray indicates an open position.
P 3.8.2.21.3		Automatic Programmer				
		CAMERA PROGRAM sw - ENABLE				
		PROGRAMMER ON lt - off.				
P 3.8.2.22		Voice record and write in logbook the time of photometer extension.				Time:

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 16 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
P 3.9		Proceed to experiment operations. Note: Position T027/S073 POWER sw - OFF, if photometer scanning operations are not started within 10 min.				
O = 190 min SL-1/SL-2: 17:50 GMT (13:50 CST) SL-3: TBD SL-4: TBD	Commence experiment operation:					Cover (or verify coverage) of OA windows. Verify momentum dump inhibited if required.
O 1.0	CDR	Conduct photometer calibration and program scans.				
O 1.1		Restrain logbook in usage position.				
O 1.2		Verify proper configuration of panel 617 MODE SELECT switches (as necessary for SAL operation):				Refer to Operation Step No. P 2.3.
O 1.3		Configure Experiment Recorder Control Panel (542): • TAPE RECORDERS EXP 1 - RECORD • TAPE RECORDERS EXP 1 lt - ON (verify) • TAPE RECORDERS EXP 2 - RECORD • TAPE RECORDERS EXP 2 lt - ON (verify)				Experiment Recorder Panel 542 is located in the OWS Experiment's area near the -Z SAL.
O 1.4		Activate Speaker Intercom (S/I) panel: • S/I CHAN B - OFF • Connect headset to S/I CHAN B (J4) connector • Crew Communications Umbilical (CCU) Power and Mode Selection - ICOM/PTT • CCU volume control - adjust as required • S/I CHAN B - ICOM/PTT • S/I RECORD/OFF - RECORD (mom) (green advisory lt - on).				Intercom Panel 520 is near the +Z SAL and Panel 540 is near the -Z SAL.

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 17 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.5		See T-027/S-073 PAD update for programs to be performed. ☐☐☐☐ S073 PREP ☐☐ SAL MAG ☐☐☐☐ LOC ☐☐☐ ☐☐☐☐ S073 EXT ☐ RODS ☐☐☐☐ OPERATION ☐☐ PROG ☐ FOV ☐ GAIN ☐☐☐☐ INHIBIT MOMENTUM DUMP SHAFT ☐☐☐☐ TRUNNION ☐☐☐ UPPER ☐☐☐☐ UPPER ☐☐☐ LOWER ☐☐☐☐ LOWER ☐☐☐ ☐☐☐☐/☐☐☐☐ PROGRAM START/STOP ☐☐☐☐ ENABLE MOMENTUM DUMP REMARKS _____				
O 1.6		Obtain appropriate program initialization summary sheet:				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 18 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.1		Program 0a - System Monitoring				Operating Time: 94 min
		Common Control Panel				
		• SHAFT ind - 000				
		• TRUNNION ind - 020				
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 0				
		• REPS ind - 55				
		• ORBITAL PERIOD ADJUST ind - 00				See PAD
		• TRUNNION UPPER LIMIT ind - N/A				No trunnion movement occurs.
		• TRUNNION LOWER LIMIT ind - N/A				No trunnion movement occurs.
		• SHAFT UPPER LIMIT ind - N/A				No shaft movement occurs.
		• SHAFT LOWER LIMIT ind - N/A				No shaft movement occurs.
		• CAMERA PROGRAM sw - N/A				No camera operation occurs.

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 19 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.2		Programs 1a - Contamination				Operation Time: 40 min (two 20 min operations).
		Common Control Panel				
		• SHAFT ind -				See PAD
		o TRUNNION ind - 100				
		Manual Control Panel				
		o FW A ind - 0				
		o FW B ind - 0				
		• FW AUTO sw - A & B				
		o FOV ind - 3/1				Position 3 for +Z SAL and Position 1 for -Z SAL.
		o CAMERA SHT ind - bp				
		o CAMERA SHUTTER sw - OPEN/CLOSE				
		o PMT SHT ind - bp				
		o PMT CAP ind - bp				
		o PMT SHUTTER sw - AUTO				
		o PMT CAP sw - AUTO				
		o PMT GAIN sw - MED				
		Automatic Programmer				
		o MODE ind - 1				
		o REPS ind - 11				
		o ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind - N/A				
		o TRUNNION LOWER LIMIT ind - N/A				
		o SHAFT UPPER LIMIT ind - N/A				
		o SHAFT LOWER LIMIT ind - N/A				
		o CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 20 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.3		Program 1b - Gegenschein				Operating Time: 48 min
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 1				
		• REPS ind - 24				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind - N/A				
		• TRUNNION LOWER LIMIT ind - N/A				
		• SHAFT UPPER LIMIT ind - N/A				
		• SHAFT LOWER LIMIT ind - N/A				
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 21 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.4		Program 1c - Contamination				Operating Time: 20 min
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 1				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 1				
		• REPS ind - 11				
		• ORBITAL PERIOD ADJUST ind - 00				See PAD
		• TRUNNION UPPER LIMIT ind - N/A				See PAD
		• TRUNNION LOWER LIMIT ind - N/A				See PAD
		• SHAFT UPPER LIMIT ind - N/A				See PAD
		• SHAFT LOWER LIMIT ind - N/A				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 22 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satisfactory	Anomaly		
O 1.6.5		Program 1d - Ecliptic Poles (N&S)				Operating Time: 15 min
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 1				
		• REPS ind - 06				
		• ORBITAL PERIOD ADJUST ind - 00				See PAD
		• TRUNNION UPPER LIMIT ind - N/A				See PAD
		• TRUNNION LOWER LIMIT ind - N/A				See PAD
		• SHAFT UPPER LIMIT ind - N/A				See PAD
		• SHAFT LOWER LIMIT ind - N/A				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 23 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.6		Program 1e - Celestial Poles (N&S)				Operating Time: 60 min (30 min/pole).
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		o FW AUTO sw - A&B				
		o FOV ind - 0				
		o CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		o PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		o PMT GAIN sw - MED				
		Automatic Programmer				
		o MODE ind - 1				
		• REPS ind - 16				
		• ORBITAL PERIOD ADJUST ind - 00				See PAD
		• TRUNNION UPPER LIMIT ind - N/A				See PAD
		• TRUNNION LOWER LIMIT ind - N/A				See PAD
		• SHAFT UPPER LIMIT ind - N/A				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 24 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.7		Program 2a - In Ecliptic (Anti-Solar View)				Operating Time: 19 min
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 2				
		• REPS ind - 01				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind -				See PAD
		• TRUNNION LOWER LIMIT ind -				See PAD
		• SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 25 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.8		Program 2b - Eclipitc (Solar View)				Operating Time: 38 min (two 19 min)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD.
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind -				See PAD
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw -				See PAD
		Automatic Programmer				
		• MODE ind - 2				
		• REPS ind - 01				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind -				See PAD
		• TRUNNION LOWER LIMIT ind -				See PAD
		• SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 26 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.9		Program 2c - Verticle Circle				Operating Time: 60 min (two 30 min)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 2				
		• REPS ind - 02				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind -				See PAD
		• TRUNNION LOWER LIMIT ind -				See PAD
		• SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 27 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.10		Program 2d - Verticle Circle				Operating Time: 60 min (two 30 min)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		○ FW A ind - 0				
		○ FW B ind - 0				
		○ FW AUTO sw - A&B				
		• FOV ind -				See PAD
		○ CAMERA SHT ind - bp				
		○ CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		○ PMT CAP sw - AUTO				
		• PMT GAIN sw -				See PAD
		Automatic Programmer				
		○ MODE ind - 2				
		○ REPS ind - 02				
		○ ORBITAL PERIOD ADJUST ind - 00				
		○ TRUNNION UPPER LIMIT ind -				See PAD
		○ TRUNNION LOWER LIMIT ind -				See PAD
		○ SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 28 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.11		Program 3a - Perpendicular to Ecliptic				Operating Time: 17 min
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 3				
		• REPS ind - 01				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind - N/A				
		• TRUNNION LOWER LIMIT ind - N/A				
		• SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 29 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.12		Program 3b - Contamination				Operating Time: 68 min (four 17 min)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind - 013, 016, 022, and 025				See PAD for changes
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind -				See PAD
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 3				
		• REPS ind - 01				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind - N/A				See PAD
		• TRUNNION LOWER LIMIT ind - N/A				See PAD
		• SHAFT UPPER LIMIT ind - 374				See PAD for changes
		• SHAFT LOWER LIMIT ind - 000				See PAD for changes
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 30 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.13		Program 3c - Gegenschien Common Control Panel • SHAFT ind - 000 • TRUNNION ind - 002 and 003 Manual Control Panel • FW A ind - 0 • FW B ind - 0 • FW AUTO sw - A&B • FOV ind - 0 • CAMERA SHT ind - bp • CAMERA SHUTTER sw - OPEN/CLOSE • PMT SHT ind - bp • PMT CAP ind - bp • PMT SHUTTER sw - AUTO • PMT CAP sw - AUTO • PMT GAIN sw - MED Automatic Programmer • MODE ind - 3 • REPS ind - 01 • ORBITAL PERIOD ADJUST ind - 00 • TRUNNION UPPER LIMIT ind - N/A • TRUNNION LOWER LIMIT ind - N/A • SHAFT UPPER LIMIT ind - 374 • SHAFT LOWER LIMIT ind - 000 • CAMERA PROGRAM sw - ENABLE				Operating Time: 34 min (two 17 min)

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 31 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.14		Program 3d - Contamination				Operating Time: 68 min (four 17 min)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 3				
		• REPS ind - 01				
		• ORBITAL PERIOD ADJUST ind - 00				
		• TRUNNION UPPER LIMIT ind - N/A				
		• TRUNNION LOWER LIMIT ind - N/A				
		• SHAFT UPPER LIMIT ind -				See PAD
		• SHAFT LOWER LIMIT ind -				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 32 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.15		Program 4a - Gegenschein				Operating Time: 160 min (16 min per orbit)
		Common Control Panel				
		• SHAFT ind - 000				See PAD for changes
		• TRUNNION ind - 002				See PAD for changes
		Manual Control Panel				
		• FW A ind - 0				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				See PAD for changes
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				See PAD for changes
		Automatic Programmer				
		• *MODE* ind - 4				
		• REPS ind - 12				
		• ORBITAL PERIOD ADJUST ind -				See PAD
		• TRUNNION UPPER LIMIT ind - 024 †				See PAD for changes
		• TRUNNION LOWER LIMIT ind - 002 †				See PAD for changes
		• SHAFT UPPER LIMIT ind - 374 ††				See PAD for changes
		• SHAFT LOWER LIMIT ind - 000 ††				See PAD for changes
		• CAMERA PROGRAM sw - ENABLE				See PAD for changes

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

† Trunnion upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit, and the 3rd octal number is set to 0, 2, 4, or 6.

†† Shaft upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit.

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 33 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.16		Program 4b - Inner Zodiacal Light/Contamination				Operating Time: 320 min (32 min/orbit)
		Common Control Panel				
		• SHAFT ind - 000				
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 1				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind -				See PAD
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw -				See PAD
		Automatic Programmer				
		• MODE ind - 4				
		• REPS ind - 12				
		• ORBITAL PERIOD ADJUST ind -				See PAD
		• TRUNNION UPPER LIMIT ind - †				See PAD
		• TRUNNION LOWER LIMIT ind - †				See PAD
		• SHAFT UPPER LIMIT ind - ††				See PAD
		• SHAFT LOWER LIMIT ind - ††				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

† Trunnion upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit and the 3rd octal number is set to 0, 2, 4, or 6.

†† Shaft upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit.

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 34 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.17		Program 5a - All Sky Mapping				Operating Time: 320 min (32 min/orbit)
		Common Control Panel				
		• SHAFT ind -				See PAD
		• TRUNNION ind -				See PAD
		Manual Control Panel				
		• FW A ind - 1				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind - 0				
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw - MED				
		Automatic Programmer				
		• MODE ind - 5				
		• REPS ind - 12				
		• ORBITAL PERIOD ADJUST ind -				See PAD
		• TRUNNION UPPER LIMIT ind - †				See PAD
		• TRUNNION LOWER LIMIT ind - †				See PAD
		• SHAFT UPPER LIMIT ind - ††				See PAD
		• SHAFT LOWER LIMIT ind - ††				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

† Trunnion upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit, and the 3rd octal number is set to 0 or 4.

†† Shaft upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit

TABLE T-111. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 35 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.18		Program 5b - All Sky Mapping				Operating Time: 290 min (29 min/orbit)
		Common Control Panel				
		• SHAFT ind - 000				See PAD
		• TRUNNION ind - 013				See PAD
		Manual Control Panel				
		• FW A ind - 1				
		• FW B ind - 0				
		• FW AUTO sw - A&B				
		• FOV ind -				See PAD
		• CAMERA SHT ind - bp				
		• CAMERA SHUTTER sw - OPEN/CLOSE				
		• PMT SHT ind - bp				
		• PMT CAP ind - bp				
		• PMT SHUTTER sw - AUTO				
		• PMT CAP sw - AUTO				
		• PMT GAIN sw -				See PAD
		Automatic Programmer				
		• MODE ind - 5				
		• REPS ind - 12				
		• ORBITAL PERIOD ADJUST ind -				See PAD
		• TRUNNION UPPER LIMIT ind - †				See PAD
		• TRUNNION LOWER LIMIT ind - †				See PAD
		• SHAFT UPPER LIMIT ind - ††				See PAD
		• SHAFT LOWER LIMIT ind - ††				See PAD
		• CAMERA PROGRAM sw - ENABLE				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

† Trunnion upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit, and the 3rd octal number is set to 0 or 4.

†† Shaft upper and lower limit PBRS to any desired position such that the upper limit is ≥ lower limit.

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 36 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
O 1.6.19		Program 6 - Stowage Position Return				Operating Time: 1.8 min (max)
		Common Control Panel				
		• SHAFT ind - N/A				Trunnion moves to 000, then shaft moves to 040.
		• TRUNNION ind - N/A				
		Manual Control Panel				
		• FW A ind - N/A				
		• FW B ind - N/A				
		• FW AUTO sw - N/A				
		• FOV ind - N/A				
		• CAMERA SHT ind - N/A				
		• CAMERA SHUTTER sw - N/A				
		• PMT SHT ind - N/A				
		• PMT CAP ind - N/A				
		• PMT SHUTTER sw - N/A				
		• PMT CAP sw - N/A				
		• PMT GAIN sw - N/A				
		Automatic Programmer				
		• MODE ind - 6				
		• REPS ind - N/A				
		• ORBITAL PERIOD ADJUST ind - N/A				
		• TRUNNION UPPER LIMIT ind - N/A				
		• TRUNNION LOWER LIMIT ind - N/A				
		• SHAFT UPPER LIMIT ind - N/A				
		• SHAFT LOWER LIMIT ind - N/A				
		• CAMERA PROGRAM sw - N/A				No camera operation occurs.

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

MSFC - One Time Form 17-1 (March 1972)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 37 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satisfactory	Anomaly		
O 1.7		Position CAMERA PROGRAM sw - ENABLE or OFF as required.				Not necessary for mode 0 and 6 programs.
O 1.8		Move CAMERA SHUTTER sw to OPEN/CLOSE 20 times (10 frames), as required.				Switch (S14). Not necessary for mode 0 and 6 programs.
O 1.9		Verify that CAMERA SHT - bp.				Display (DS-4)
O 1.10		Acquire T-027/S-073 pad update for appropriate program and initialize using summary sheets in Operation Step No. O 1.6.				Cover OWS crew quarter's window and CSM viewports for anti-solar photometer scan operations.
O 1.11		Position PROGRAM sw - START (mom).				Switch (S4)
O 1.12		Verify PROGRAMMER ON lt - on.				Automatic Programmer
O 1.13		Verify program operation as specified on program summary sheets.				If automatic programmer malfunctions, operator can perform necessary observing programs manually.
O 1.14		Record on voice and in logbook any deviations from T-027/S-073 update pad. Record on tape and in logbook the observing program actuation time and date. Note: Repeat Operation Step Nos. O 1.5 through O 1.14 as required by update pad.				Disconnect headset and stow.
O 1.15		S/I RECORD/OFF - OFF (mom) (green advisory lt - off).				See update pad for EXP 1 and EXP 2 recorders OFF time.
O 1.16	GND	Acquire and evaluate the following data during and/or after each programmed photometer scan or calibration.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 38 of 83)

Operation Step Number*	Data: Return: Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.1	0574 or 0579	Event - Exp T027, FW A 2**0 K7270Z027 K7270T027	WP1C045I04PJ40 WP1C045F04PJ37	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and Ā		Photometer output signal inverted by TM system, but console logic inverts the TM system signal back to normal. Therefore, console light logic is = 0.
		Typical K7270Z027 or K7270T027 Measurement:										
		Signal Profile (Vdc): 29.5 / 0; Duration (sec): 2, 14; Signal Logic: 1 (OFF=1), 0 (ON=0); Console Logic (0574 or 0579); Filter Wheel Position Logic										
										Refer to O 1.16.4		
O 1.16.2	0584 or 0589	Event - Exp T027, FW A 2**1 K7271Z027 K7271T027	WP1C045H04PJ39 WP1C065I04PK40	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and Ā		
		Typical K7271Z027 or K7271T027 Measurement:										

P - Preparation
O - Operation
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 39 of 83)

Operation Step Number*	Recorder Number	Data: Return — Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check — Satisfactory / Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.2 (Concluded)		Signal Profile (Vdc): Signal Logic — Console Logic (0584 or 0589). 29.5 / 0; 1 (OFF=1), 0 (ON=0); 14, 38; Duration (sec). FW Position Logic							Refer to O 1.16.4		See O 1.16.1
O 1.16.3	0594 or 0599	Event - Exp T027, FW A 2**2 K7272Z027 WP1C045G04PJ38 K7272T027 WP1C065H04PK39	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and Ā		
		Typical K272Z027 or K7272T027 Measurement: Signal Profile (Vdc): Signal Logic — Console Light (0594 or 0599). 29.5 / 0; 1 (OFF=1), 0 (ON=0); 38, 62; Duration (sec). FW Position Logic							Refer to O 1.16.4		See O 1.16.1

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

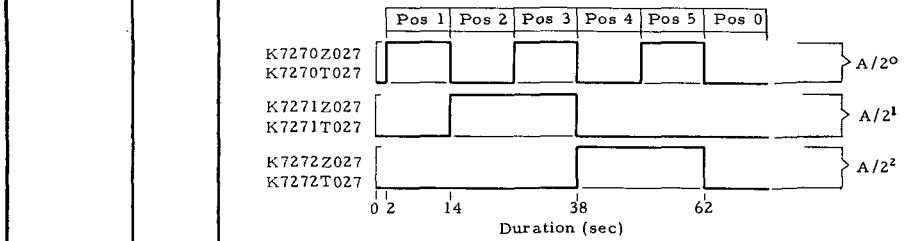
***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 40 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Data Return / Evaluation Check: Satisfactory	Data Return / Evaluation Check: Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.4	FW A Composite Signal											
O 1.16.5	0575 or 0580	Event - Exp T027, FW B 2**0 K7268Z027 K7268T027	WP1C025E03BK12 WP1C025H03BK15	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and $\bar{A}$		

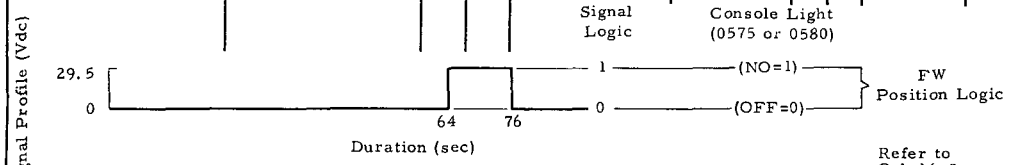


FW A Console Light Logic:

FW A Signal	FW A Position 1	2	3	4	5	0	Console Device SAL 1	SAL 2
A/2^0	ON	OFF	ON	OFF	ON	OFF	0574	0579
A/2^1	OFF	ON	ON	OFF	OFF	OFF	0584	0589
A/2^2	OFF	OFF	OFF	ON	ON	OFF	0594	0599

Refer to O 1.16.9

Typical K7268Z027 or K7268T027 Measurement:



Refer to O 1.16.8

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
$\bar{D}$ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
$\bar{A}$ - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 41 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Evaluation: Check: Anomaly	Remarks****	See Contingency Plan Number	Remarks
O 1. 16.6	0585 or 0590	Event - Exp T027, FW B 2**1		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and Ā		
		K7269Z027	WP1C035D03BK11			Read: 0 or 29.5 Vdc						
		K7269T027	WP1C025G03BK14									
		Typical K7269Z027 or K7269T027 Measurement:										
		Signal Profile (Vdc)					Signal Logic		Console Light (0585 or 590)			
		29.5					1		(ON=1)			FW Position Logic
		0					0		(OFF=0)			
		76 100 Duration (sec)										
										Refer to O 1. 16. 8		
O 1. 16. 7	0595 or 0600	Event - Exp T027, FW B 2**2		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and Ā		
		K7298Z027	WP1C025C03BK10			Read: 0 or 29.5 Vdc						
		K7298T027	WP1C025F03BK13									
		Typical K7298Z027 or K7298T027 Measurement:										

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

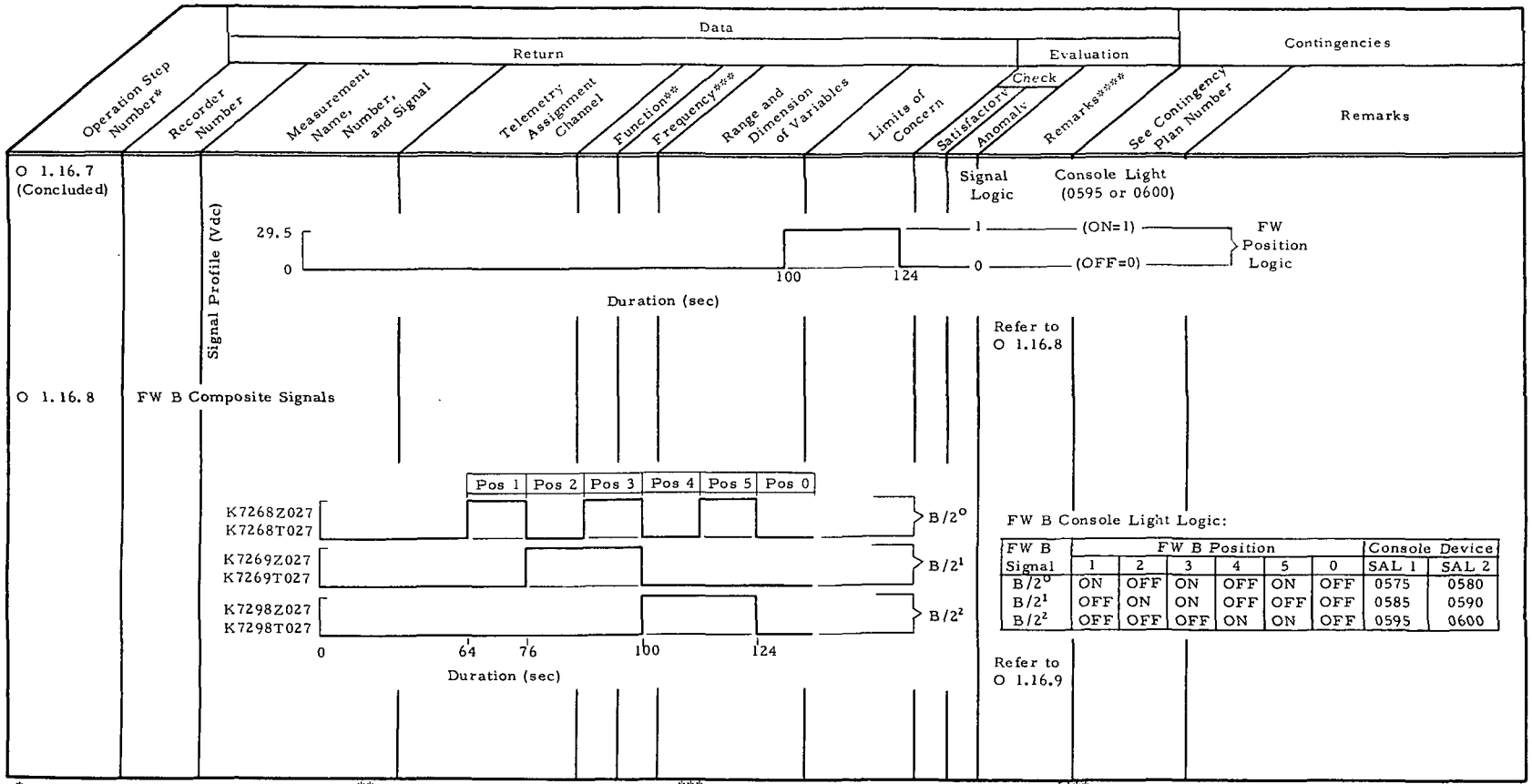
** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 42 of 83)



FW B Signal	FW B Position						Console Device	
	1	2	3	4	5	0	SAL 1	SAL 2
$B/2^0$	ON	OFF	ON	OFF	ON	OFF	0575	0580
$B/2^1$	OFF	ON	ON	OFF	OFF	OFF	0585	0590
$B/2^2$	OFF	OFF	OFF	ON	ON	OFF	0595	0600

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

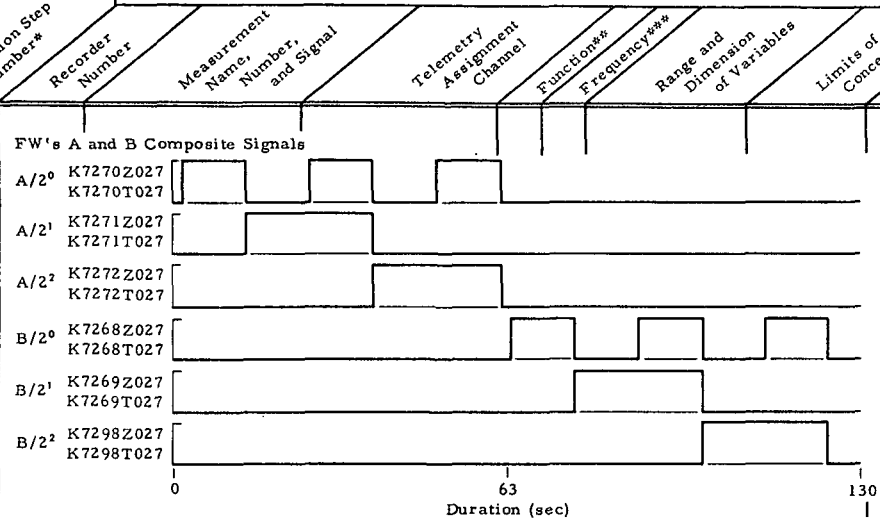
***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 43 of 83)

Operation Step Number*	Data: Return: Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.9		FW's A and B Composite Signals								Refer to O 1.16.35		FW's A&B Position and Channel Logic



FW's A&B Position and Channel Logic

Position	Bilevel Logic 2^0	2^1	2^2
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1

FW's A&B Console Light Logic:

FW Signal	FW A Position 1	2	3	4	5	0	FW B Position 1	2	3	4	5	0	Console Device SAL 1	SAL 2
$A/2^0$	ON	OFF	ON	OFF	ON	OFF							0574	0579
$A/2^1$	OFF	ON	ON	OFF	OFF	OFF							0584	0589
$A/2^2$	OFF	OFF	OFF	ON	ON	OFF							0594	0599
$B/2^0$							ON	OFF	ON	OFF	ON	OFF	0575	0580
$B/2^1$							OFF	ON	ON	OFF	OFF	OFF	0585	0590
$B/2^2$							OFF	OFF	OFF	ON	ON	OFF	0595	0600

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 44 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Check: Satisfactory	Check: Anomaly	Remarks****	See Contingency Plan Number	Remarks
	Data: Return							Evaluation			Contingencies	
O 1.16.10	0563 or 0568	Event - Exp T027, FOV Wheel 2**0		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and A		
		K7275Z027	WP1C025B03BK09			Read: 0 or 29.5 Vdc						
		K7275T027	WP1C025I0BK24									
		Typical K7275Z027 or K7275T027 Measurement:								Refer to O 1.16.13		
O 1.16.11	0573 or 0578	Event - Exp T027, FOV Wheel 2**1		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and Ā		
		K7273Z027	WP1C025I02BK08			Read: 0 or 29.5 Vdc						
		K7273T027	WP1C025H04BK23									
		Typical K7273Z027 or K7273T027 Measurement:								Refer to O 1.16.13		
O 1.16.12	0583 or 0588	Event - Exp T027, FOV Wheel 2**2		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and Ā		
		K7274Z027	WP1C025H02BK07			Read: 0 or 29.5 Vdc						
		K7274T027	WP1C025G04BK22									
		Typical K7274Z027 or K7274T027 Measurement:								Refer to O 1.16.13		

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

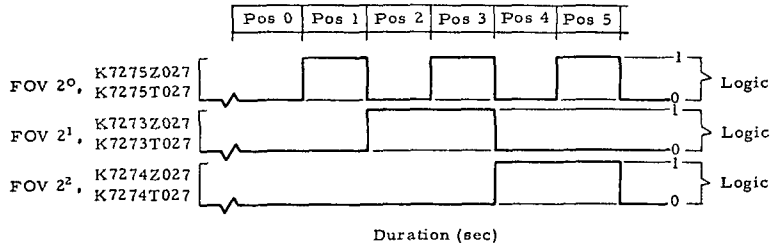
*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 45 of 83)

Operation Step Number*	Data: Return: Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.13		FOV Wheel Composite Signals								Refer to O 1.16.35		FOV Wheel Position and Channel Logic*



FOV Console Light Logic:

FOV Signal	FOV Position 0	1	2	3	4	5	Console Device SAL 1	SAL 2
2^0	OFF	ON	OFF	ON	OFF	ON	0563	0568
2^1	OFF	OFF	ON	ON	OFF	OFF	0573	0578
2^2	OFF	OFF	OFF	OFF	ON	ON	0583	0588

Position	Bilevel Logic 2^0	2^1	2^2
0	0	0	0
1	1	0	0
2	0	1	0
3	1	1	0
4	0	0	1
5	1	0	1

* Logic 0 = 0 Vdc
Logic 1 = 29.5 Vdc

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

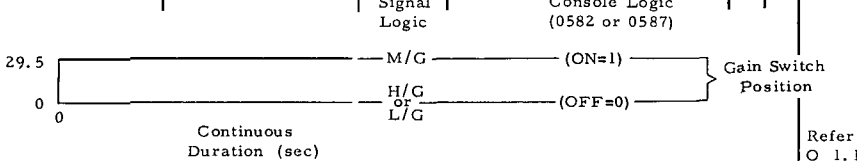
**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 46 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.14	0582 or 0587	Event - Exp T027 Phomult Tube M/G K7267Z027 K7267T027	 WP1C025G02BK06 WP1C025F04BK21	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and $\bar{A}$		
O 1.16.15	0572 or 0577	Event - Exp T027, Phomult Tube H/G K7266Z027 K7266T027	 WP1C025F02BK05 WP1C025E04BK20	E	I	Range: 0 or 32 Vdc Read: 0 or 29.5 Vdc	0 or 5 Vdc			N and $\bar{A}$		

Typical K7267Z027 or K7267T027 Measurement:



Refer to O 1.16.35

PMT Gain Console Light Logic

Gain Signal			Console Device	
High	Medium	Low	SAL 1	SAL 2
ON	OFF	OFF	0572	0577
OFF	ON	OFF	0582	0587

Typical K7266Z027 or K7266T027 Measurement:

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

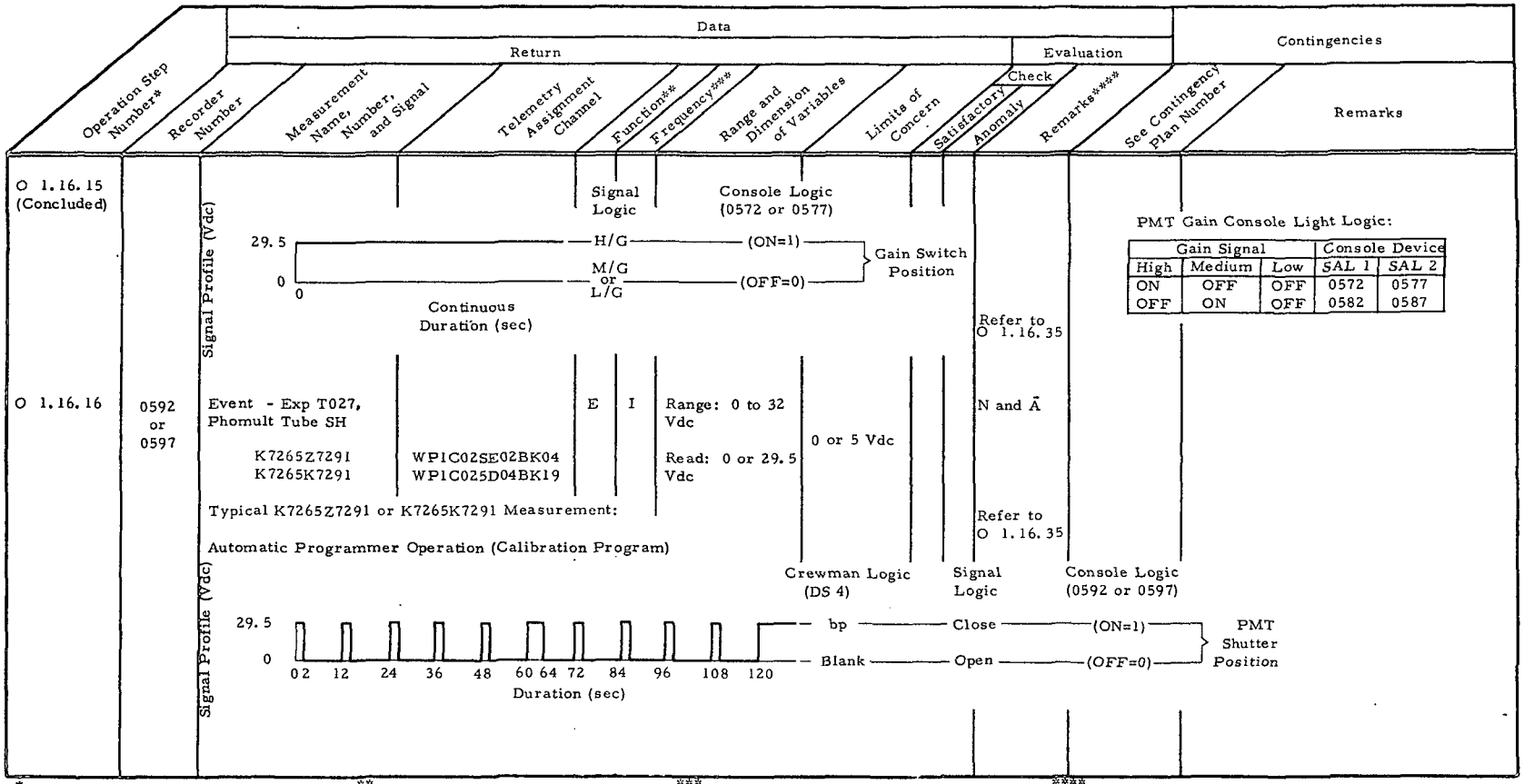
**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete (Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 47 of 83)



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

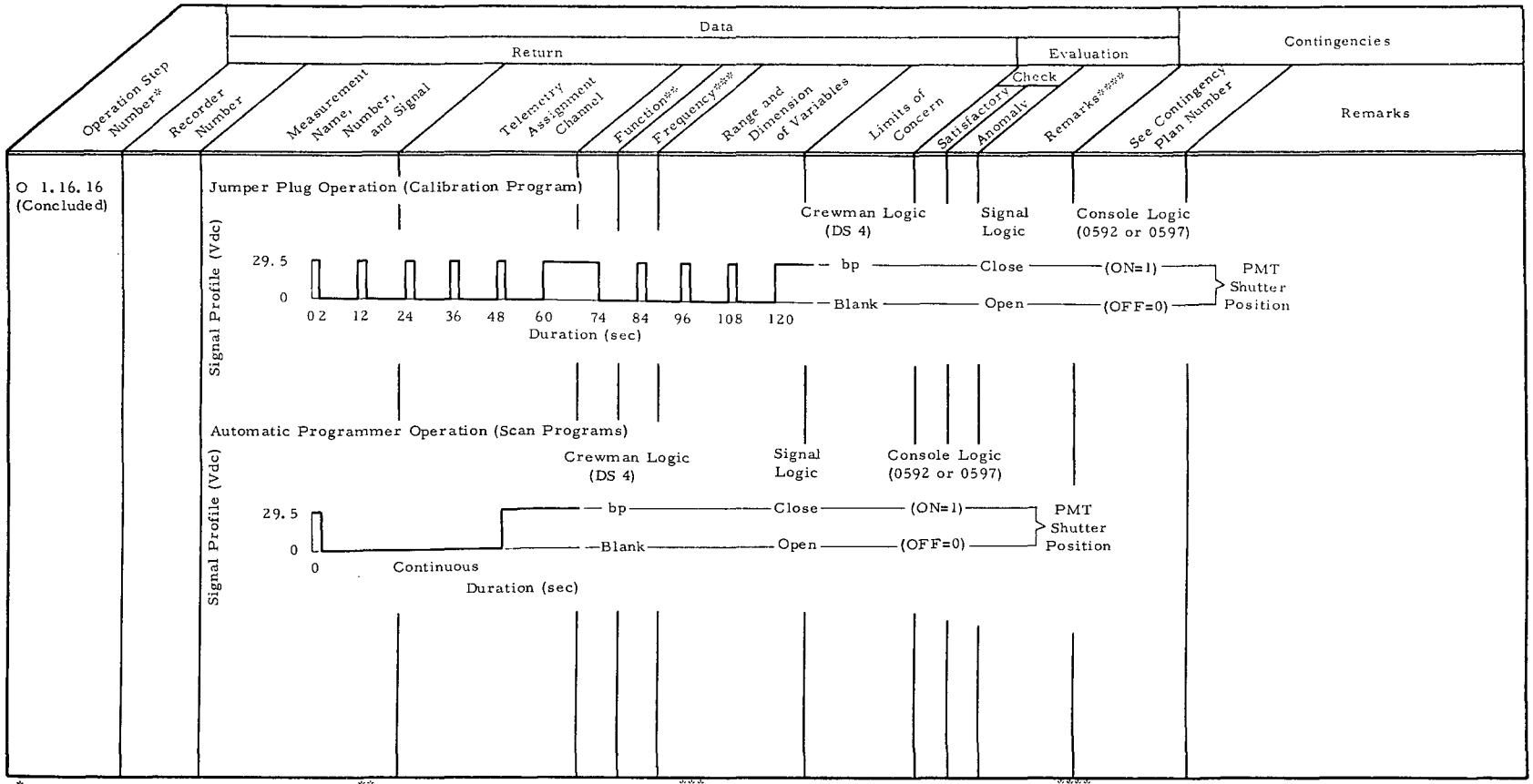
**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 48 of 83)



* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

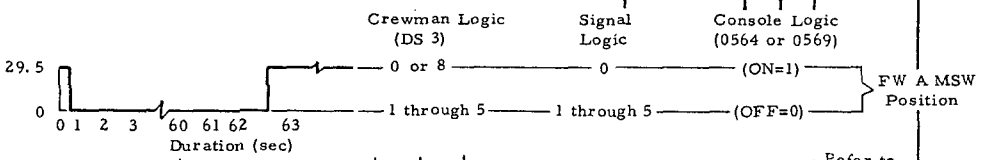
*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 49 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Satisfactory Check	Anomaly Check	Remarks****	See Contingency Plan Number	Remarks
		Data: Return						Evaluation			Contingencies	
O 1.16.17	0564 or 0569	Event - Exp T027, FW A Blk MSW		E	I	Range: 0 to 32 Vdc	0 or 5 Vdc			N and Ā		
		K7313Z7294	WP1C025D02BK03			Read: 0 to 29.5 Vdc						
		K7313K7294	WP1C025C04BK18									
		Typical K7313Z7294 or K7313K7294 Measurement:										
O 1.16.18	0565 or 0570	Event - Exp T027, FW B Blk MSW		E	I	Range: 0 or 32 Vdc	0 or 5 Vdc			N and Ā		
		K7299Z7292	WP1C025C02BK02			Read: 0 to 29.5 Vdc						
		K7299K7292	WP1C025B04BK17		1							
		Typical K7299Z7292 or K7299K7292 Measurement:										



Refer to O 1.16.35

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

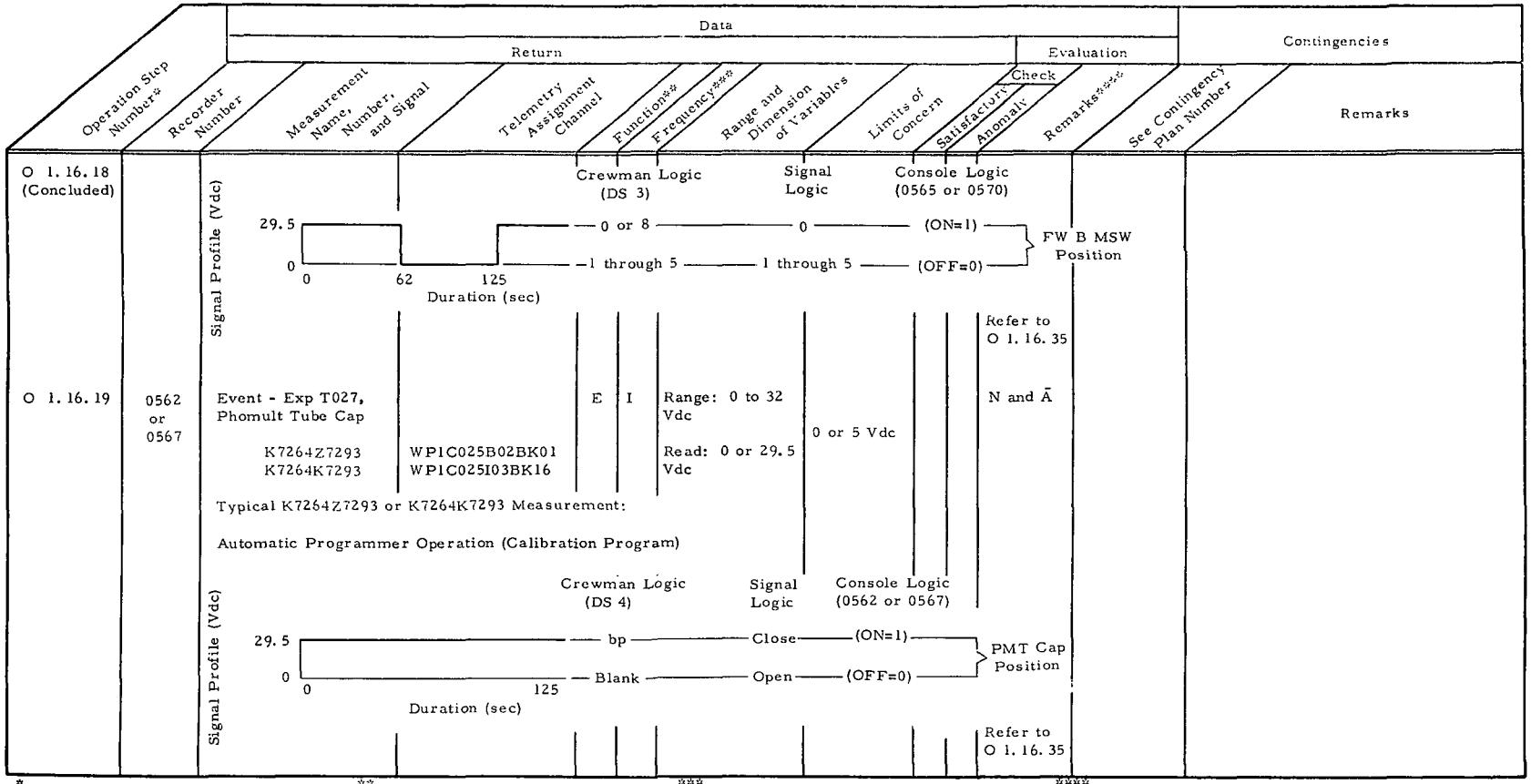
**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 50 of 83)



* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

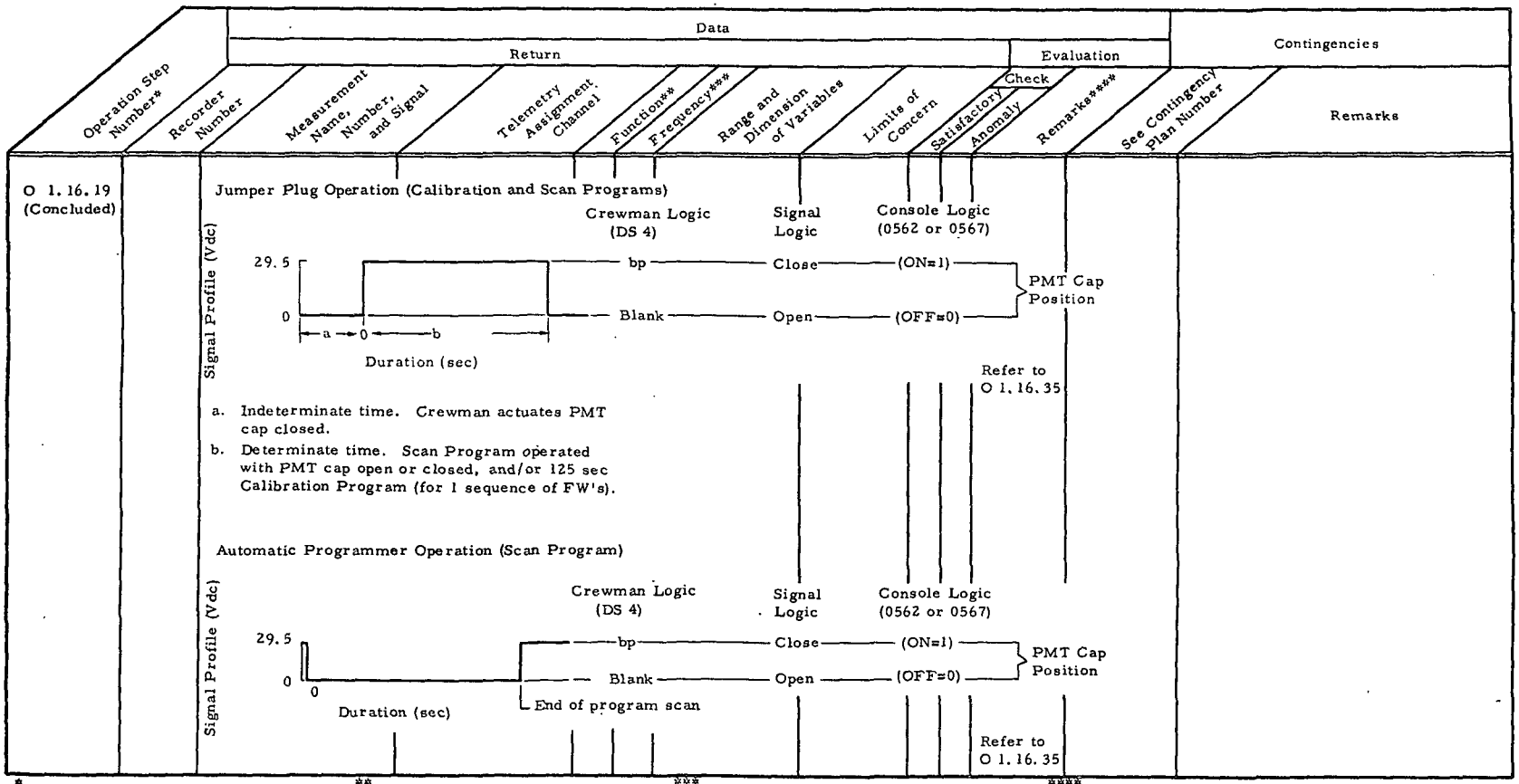
** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 51 of 83)



* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

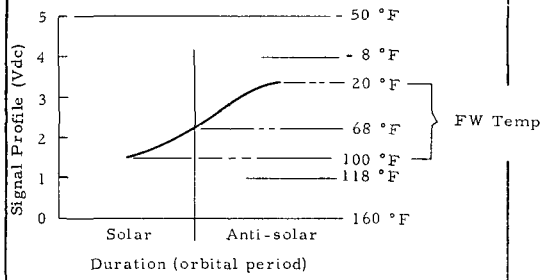
**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

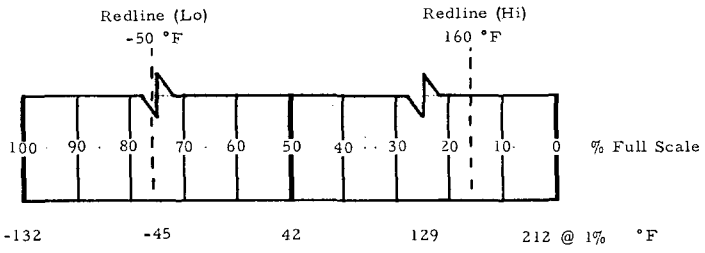
TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 52 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Evaluation: Check: Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.20	3012 or 3013	Temp - Exp T027, Filter Wheel C7068Z027 C7068T027	WP1B105A14HK52 WP1B105A31HK64	A	C	Range: 160 to -50 °F Read: 100 to 20 °F	Normal: 20≤°F≤100 Upper: 100≤°F≤118 Lower: -8≤°F≤20 Redline: 160 °F (Hi) and -50 °F (Lo)			N and Ā Refer to O 1.16.35 1 Vdc = 42 °F		Console Logic: See devices 0131, 0141, 3012, and 3013.

Typical C7068Z027 or C7068T027 Measurement:



Typical C7068Z027 or C7068T027 Strip Chart Readout:



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

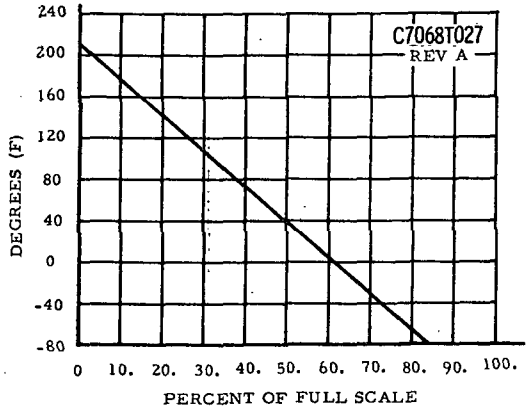
****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 53 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Evaluation: Check: Satisfactory	Evaluation: Check: Anomaly	Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1. 16. 20 (Concluded)	0131 or 0141	Meter Readout										

Typical C7068T027 Calibration Data:



CURVE FIT DATA

PCT	DEG F	PCT	DEG F	PCT	DEG F	PCT	DEG F
1.0	212.070	26.0	125.106	51.0	38.141	76.0	-48.822
2.0	208.391	27.0	121.627	52.0	34.662	77.0	-52.301
3.0	205.113	28.0	118.148	53.0	31.184	78.0	-55.779
4.0	201.034	29.0	114.670	54.0	27.705	79.0	-59.258
5.0	198.195	30.0	111.191	55.0	24.227	80.0	-62.758
6.0	194.077	31.0	107.713	56.0	20.748	81.0	-66.215
7.0	191.190	32.0	104.234	57.0	17.270	82.0	-69.694
8.0	187.720	33.0	100.756	58.0	13.791	83.0	-73.172
9.0	184.241	34.0	97.277	59.0	10.312	84.0	-76.651
10.0	180.763	35.0	93.798	60.0	8.834	85.0	-80.129
11.0	177.284	36.0	90.319	61.0	3.365	86.0	-83.608
12.0	173.806	37.0	86.841	62.0	-0.122	87.0	-87.086
13.0	170.327	38.0	83.362	63.0	-3.601	88.0	-90.565
14.0	166.845	39.0	79.884	64.0	-7.079	89.0	-94.044
15.0	163.370	40.0	76.405	65.0	-10.538	90.0	-97.322
16.0	159.091	41.0	72.927	66.0	-14.037	91.0	-101.001
17.0	156.413	42.0	69.440	67.0	-17.515	92.0	-104.480
18.0	152.934	43.0	65.970	68.0	-20.994	93.0	-107.938
19.0	149.456	44.0	62.491	69.0	-24.472	94.0	-111.437
20.0	145.977	45.0	59.012	70.0	-27.951	95.0	-114.915
21.0	142.498	46.0	55.534	71.0	-31.429	96.0	-118.394
22.0	139.020	47.0	52.055	72.0	-34.908	97.0	-121.873
23.0	135.541	48.0	48.577	73.0	-38.387	98.0	-125.351
24.0	132.003	49.0	45.098	74.0	-41.885	99.0	-128.830
25.0	128.504	50.0	41.620	75.0	-45.344	100.0	-132.308

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

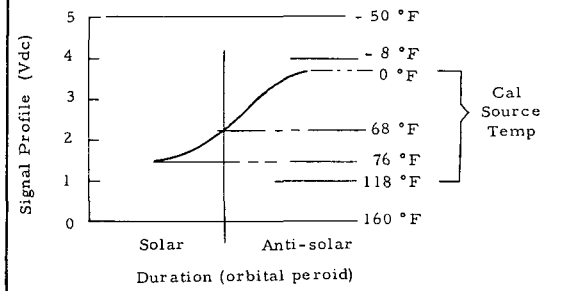
****R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

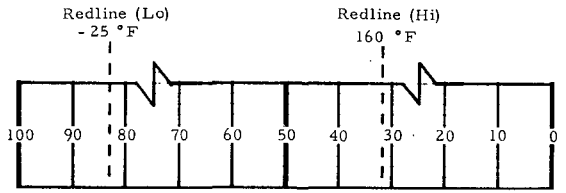
TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 54 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Evaluation: Check: Anomaly	Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.21		Temp - Exp T027, Cal Source C7066Z027 C7066T027	 WP1B105A18HK53 WP1B105A04HK65	A	C	Range: 160 to -50 °F Read: 100 to 0 °F	Normal: $0 \leqq {}^{\circ}F \leqq 100$ Upper: $76 \leqq {}^{\circ}F \leqq 118$ Lower: $-8 \leqq {}^{\circ}F \leqq 0$ *Redline:* 160 °F (Hi) and -25 °F (Lo)		N and $\bar{A}$	Refer to O 1.16.35		Console Logic: See devices 0130, 0140, 3010, and 3011.
	3010 or 3011											

Typical C7066Z027 or C7066T027 Measurement:



Typical C7066Z027 or C7066T027 Strip Chart Readout:



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete (Specified number of times)

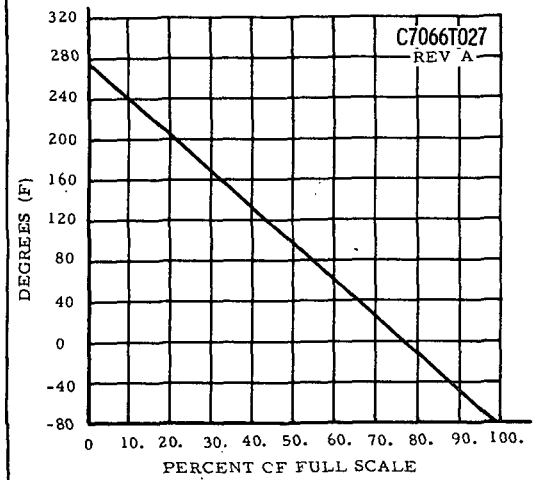
****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 55 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Data Return / Evaluation Check: Satisfactory	Data Return / Evaluation Check: Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.21 (Concluded)	0130 or 0140	Meter Readout										

Typical C7066T027 Calibration Data:



CURVE FIT DATA

PCT	DEG F	PCT	DEG F	PCT	DEG F	PCT	DEG F
1.0	271.859	26.0	181.640	51.0	91.420	76.0	1.201
2.0	268.250	27.0	178.031	52.0	87.812	77.0	-2.406
3.0	264.841	28.0	174.422	53.0	84.203	78.0	-6.015
4.0	261.032	29.0	170.813	54.0	80.594	79.0	-9.624
5.0	237.424	30.0	167.205	55.0	76.985	80.0	-13.233
6.0	253.815	31.0	163.596	56.0	73.377	81.0	-16.841
7.0	250.206	32.0	159.987	57.0	69.768	82.0	-20.450
8.0	248.597	33.0	156.378	58.0	66.159	83.0	-24.059
9.0	242.989	34.0	152.770	59.0	62.550	84.0	-27.668
10.0	239.380	35.0	149.161	60.0	68.942	85.0	-31.276
11.0	235.771	36.0	145.552	61.0	55.333	86.0	-34.885
12.0	232.162	37.0	141.943	62.0	51.724	87.0	-38.494
13.0	228.554	38.0	138.335	63.0	48.115	88.0	-42.103
14.0	224.945	39.0	134.726	64.0	44.507	89.0	-45.712
15.0	221.336	40.0	131.117	65.0	40.898	90.0	-49.320
16.0	217.727	41.0	127.508	66.0	37.289	91.0	-52.929
17.0	214.119	42.0	123.900	67.0	33.680	92.0	-56.538
18.0	210.510	43.0	120.291	68.0	30.071	93.0	-60.147
19.0	206.901	44.0	116.682	69.0	26.463	94.0	-63.755
20.0	203.292	45.0	113.073	70.0	22.854	95.0	-67.364
21.0	199.683	46.0	109.465	71.0	19.245	96.0	-70.973
22.0	196.075	47.0	105.856	72.0	15.636	97.0	-74.582
23.0	192.466	48.0	102.247	73.0	12.028	98.0	-78.190
24.0	188.857	49.0	98.638	74.0	8.419	99.0	-81.799
25.0	185.248	50.0	95.029	75.0	4.810	100.0	-85.408

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

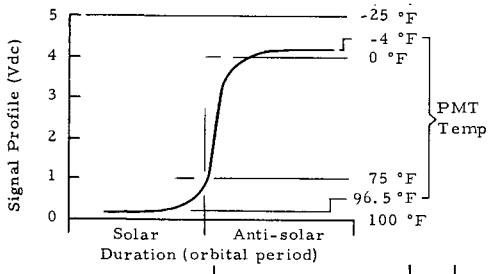
**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

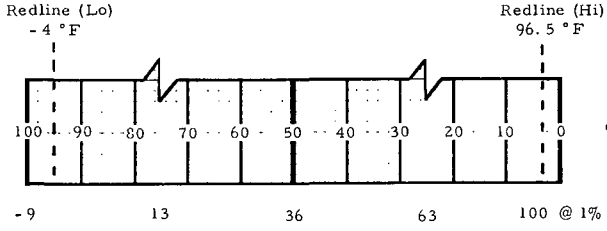
TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 56 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.22	3008 or 3009	Temp - Exp T027, Phomult Tube C7067Z027 C7067T027	WP1B150A22HK54 WP1B105A08HK66	A	C	Range: 100 to -25 °F Read: 86 to 0 °F	Normal: 10≦°F≦86 Upper: 86≦°F≦90 Lower: 0≦°F≦10 Redline: 96.5 °F (Hi) and -4 °F (Lo)			N and Ā Refer to O 1.16.35		Console Logic: See devices 0129, 0139, 3008, and 3009.

Typical C7067Z027 or C7067T027 Measurement



Typical C7067Z027 or C7067T027 Strip Chart Readout:



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

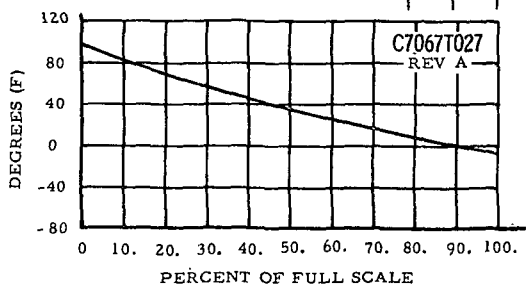
****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 57 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Data: Evaluation: Check: Satisfactory	Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.22 (Concluded)	0129 or 0139	Meter Readout										

Typical C7067T027 Calibration Data:



CURVE FIT DATA

PCT	DEG F	PCT	DEG F	PCT	DEG F	PCT	DEG F
1.0	100.207	26.0	61.683	51.0	35.292	76.0	12.479
2.0	98.269	27.0	60.470	52.0	34.347	77.0	11.585
3.0	96.373	28.0	59.276	53.0	33.407	78.0	10.691
4.0	94.517	29.0	58.099	54.0	32.471	79.0	9.798
5.0	92.699	30.0	56.939	55.0	31.539	80.0	8.907
6.0	90.916	31.0	55.794	56.0	30.611	81.0	8.016
7.0	89.175	32.0	54.664	57.0	29.686	82.0	7.127
8.0	87.466	33.0	53.549	58.0	28.764	83.0	6.239
9.0	85.792	34.0	52.448	59.0	27.845	84.0	5.332
10.0	84.152	35.0	51.359	60.0	26.929	85.0	4.467
11.0	82.545	36.0	50.284	61.0	26.014	86.0	3.584
12.0	80.967	37.0	49.220	62.0	25.102	87.0	2.702
13.0	79.420	38.0	48.168	63.0	24.192	88.0	1.823
14.0	77.904	39.0	47.126	64.0	23.284	89.0	0.946
15.0	76.416	40.0	46.095	65.0	22.378	90.0	0.071
16.0	74.955	41.0	45.074	66.0	21.472	91.0	-0.799
17.0	73.322	42.0	44.062	67.0	20.569	92.0	-1.668
18.0	72.114	43.0	43.059	68.0	19.666	93.0	-2.534
19.0	70.731	44.0	42.063	69.0	18.764	94.0	-3.395
20.0	69.372	45.0	41.076	70.0	17.864	95.0	-4.253
21.0	68.037	46.0	40.096	71.0	16.964	96.0	-5.107
22.0	66.724	47.0	39.123	72.0	16.066	97.0	-5.957
23.0	65.433	48.0	38.157	73.0	15.168	98.0	-6.601
24.0	64.163	49.0	37.198	74.0	14.271	99.0	-7.640
25.0	62.913	50.0	36.241	75.0	13.375	100.0	-8.474

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

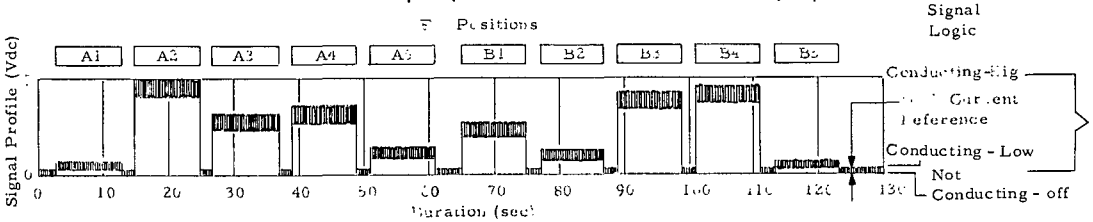
****R - Real Time
N - Near/Real Time
A - All Time

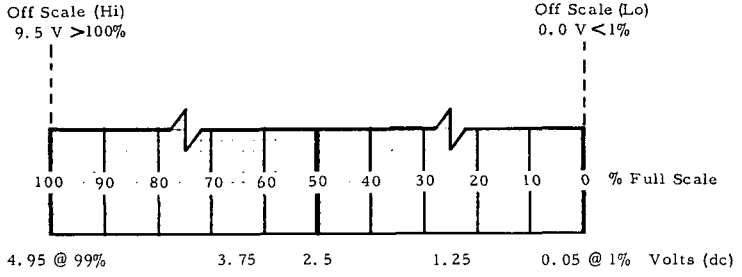
ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 58 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.23		Voltage - Exp T027, Phomult Tube M7074T027	WP1H046A01H141	A	C	Range: 0 to 5 Vdc Read: 0.5 to 4.5 Vdc	0 to 5 Vdc			Refer to O 1.16.35 N and $\bar{A}$		See Remarks in Table T-II for M7074T027 Crewman Logic (DS 5): the interval between 0 to 5 Vdc Console Logic: See devices 0142 and 3001.
	3001	Typical M7074T027 Strip Chart Readout:										

Typical M7074T027 Measurement:





Correlation Scale

Vdc	MCR AMP
0	0
0.5†	0.1
1	0.2
2	0.4
3	0.6
4	0.8
5	1.0

† Dark Current Reference

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
$\bar{D}$ - Discrete
(Specified number of times)

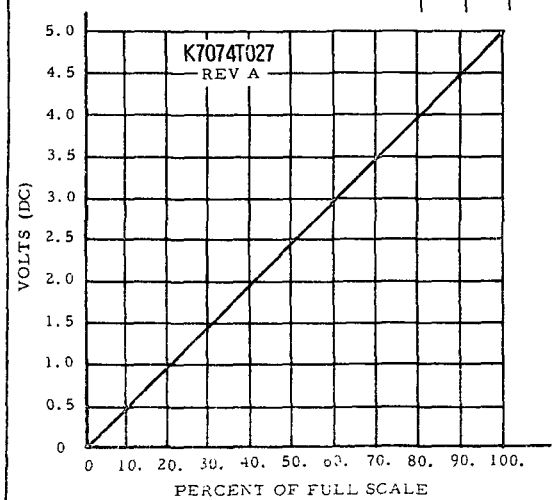
****R - Real Time
N - Near/Real Time
$\bar{A}$ - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 59 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Data Return / Evaluation Check: Satisfactory	Data Return / Evaluation Check: Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.23 (Concluded)	0142	Meter Readout										

Typical M7074T027 Calibration Data:



CURVE FIT DATA

PCT	VOLTS	PCT	VOLTS	PCT	VOLTS	PCT	VOLTS
1.0	0.05000	26.0	1.30000	51.0	2.55000	76.0	3.80000
2.0	0.10000	27.0	1.35000	52.0	2.60000	77.0	3.85000
3.0	0.15000	28.0	1.40000	53.0	2.65000	78.0	3.90000
4.0	0.20000	29.0	1.45000	54.0	2.70000	79.0	3.95000
5.0	0.25000	30.0	1.50000	55.0	2.75000	80.0	4.00000
6.0	0.30000	31.0	1.53000	56.0	2.80000	81.0	4.05000
7.0	0.35000	32.0	1.60000	57.0	2.85000	82.0	4.10000
8.0	0.40000	33.0	1.63000	58.0	2.90000	83.0	4.15000
9.0	0.45000	34.0	1.70000	59.0	2.95000	84.0	4.20000
10.0	0.50000	35.0	1.75000	60.0	3.00000	85.0	4.25000
11.0	0.55000	36.0	1.80000	61.0	3.05000	86.0	4.30000
12.0	0.60000	37.0	1.83000	62.0	3.10000	87.0	4.35000
13.0	0.65000	38.0	1.90000	63.0	3.15000	88.0	4.40000
14.0	0.70000	39.0	1.95000	64.0	3.20000	89.0	4.45000
15.0	0.75000	40.0	2.00000	65.0	3.25000	90.0	4.50000
16.0	0.80000	41.0	2.05000	66.0	3.30000	91.0	4.55000
17.0	0.85000	42.0	2.10000	67.0	3.35000	92.0	4.60000
18.0	0.90000	43.0	2.15000	68.0	3.40000	93.0	4.65000
19.0	0.95000	44.0	2.20000	69.0	3.45000	94.0	4.70000
20.0	1.00000	45.0	2.25000	70.0	3.50000	95.0	4.75000
21.0	1.05000	46.0	2.30000	71.0	3.55000	96.0	4.80000
22.0	1.10000	47.0	2.35000	72.0	3.60000	97.0	4.85000
23.0	1.15000	48.0	2.40000	73.0	3.65000	98.0	4.90000
24.0	1.20000	49.0	2.45000	74.0	3.70000	99.0	4.95000
25.0	1.25000	50.0	2.50000	75.0	3.75000	100.0	9.00000

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

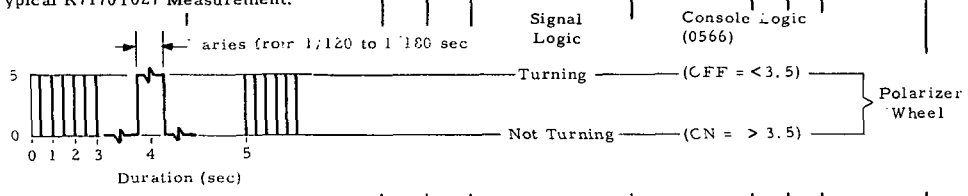
** E - Event
H - Housekeeping
A - Analog
D - Digital

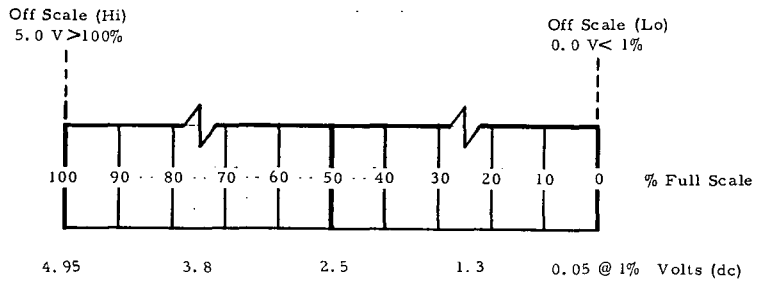
*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
A - All Time

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 60 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Check: Satisfactory	Check: Anomaly	Remarks****	See Contingency Plan Number	Remarks
O 1.16.24		Event - Exp T027, Pol Wheel Sync K7170T027	WP1H036A01H142	E	I	Range: 0 or 5 Vdc Read: 0 or 5 Vdc	0 to 5 Vdc			N and $\bar{A}$ Refer to O 1.16.35		
		Typical K7170T027 Measurement:										
	3000	Typical K7170T027 Strip Chart Readout:										





*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̂ - Discrete
(Specified number of times)

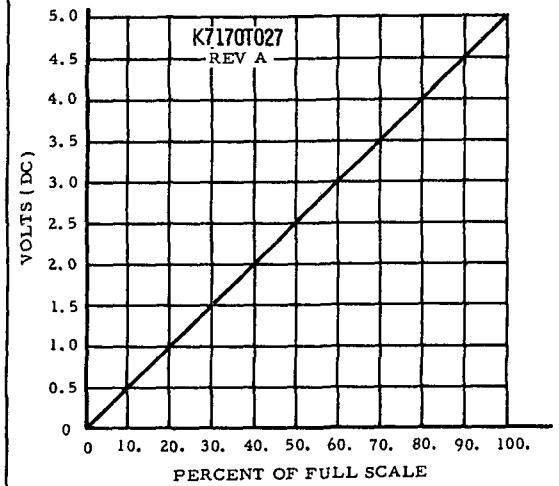
****R - Real Time
N - Near/Real Time
$\bar{A}$ - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 61 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check: Satisfactory	Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.24 (Concluded)	0566	Meter Readout										

Typical K7170T027 Calibration Data:



CURVE FIT DATA

PCT	VOLTS	PCT	VOLTS	PCT	VOLTS	PCT	VOLTS
1.0	0.05000	26.0	1.30000	51.0	2.55000	76.0	3.80000
2.0	0.10000	27.0	1.35000	52.0	2.60000	77.0	3.85000
3.0	0.15000	28.0	1.40000	53.0	2.65000	78.0	3.90000
4.0	0.20000	29.0	1.45000	54.0	2.70000	79.0	3.95000
5.0	0.25000	30.0	1.50000	55.0	2.75000	80.0	4.00000
6.0	0.30000	31.0	1.55000	56.0	2.80000	81.0	4.05000
7.0	0.35000	32.0	1.60000	57.0	2.85000	82.0	4.10000
8.0	0.40000	33.0	1.65000	58.0	2.90000	83.0	4.15000
9.0	0.45000	34.0	1.70000	59.0	2.95000	84.0	4.20000
10.0	0.50000	35.0	1.75000	60.0	3.00000	85.0	4.25000
11.0	0.55000	36.0	1.80000	61.0	3.05000	86.0	4.30000
12.0	0.60000	37.0	1.85000	62.0	3.10000	87.0	4.35000
13.0	0.65000	38.0	1.90000	63.0	3.15000	88.0	4.40000
14.0	0.70000	39.0	1.95000	64.0	3.20000	89.0	4.45000
15.0	0.75000	40.0	2.00000	65.0	3.25000	90.0	4.50000
16.0	0.80000	41.0	2.05000	66.0	3.30000	91.0	4.55000
17.0	0.85000	42.0	2.10000	67.0	3.35000	92.0	4.60000
18.0	0.90000	43.0	2.15000	68.0	3.40000	93.0	4.65000
19.0	0.95000	44.0	2.20000	69.0	3.45000	94.0	4.70000
20.0	1.00000	45.0	2.25000	70.0	3.50000	95.0	4.75000
21.0	1.05000	46.0	2.30000	71.0	3.55000	96.0	4.80000
22.0	1.10000	47.0	2.35000	72.0	3.60000	97.0	4.85000
23.0	1.15000	48.0	2.40000	73.0	3.65000	98.0	4.90000
24.0	1.20000	49.0	2.45000	74.0	3.70000	99.0	4.95000
25.0	1.25000	50.0	2.50000	75.0	3.75000	100.00	5.00000

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

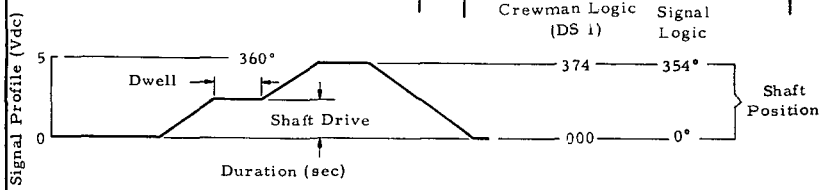
**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 62 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Evaluation: Check Satisfactory	Evaluation: Check Anomaly	Remarks****	See Contingency Plan Number	Remarks
O 1.16.25		Posit - Exp T027, Shaft Info G7025T027	WP1C065A02H144	A	C	Range: 0 to 360° Read: 0 to 355°	CW = > 355° CCW = > 358°			N and Ā		Console Logic: See devices 0128 and 3002.
	3002	Typical G7025T027 Strip Chart Readout:										

Typical G7025T027 Measurement:



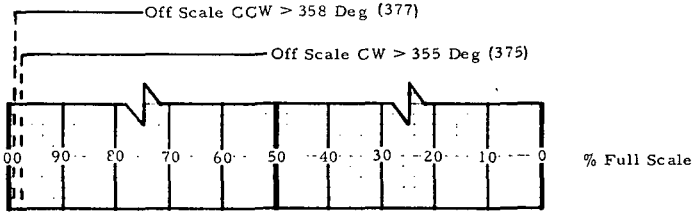
Shaft Motor Drive Rate = 4 °/sec

Refer to O 1.16.35

Shaft Correlation Scale

Vdc	Bit	Deg	Octal
0	000	0	000
1	051	72	063
2	103	144	147
3	154	216	232
4	205	288	315
4.92	252	354	374
4.93	253	355	375
4.97	255	358	377
5	-	360	-

Typical G7025T027 Strip Chart Readout:



362	272	181	91	4 @ 1%	Degrees
402	302	201	101	003	Octal

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

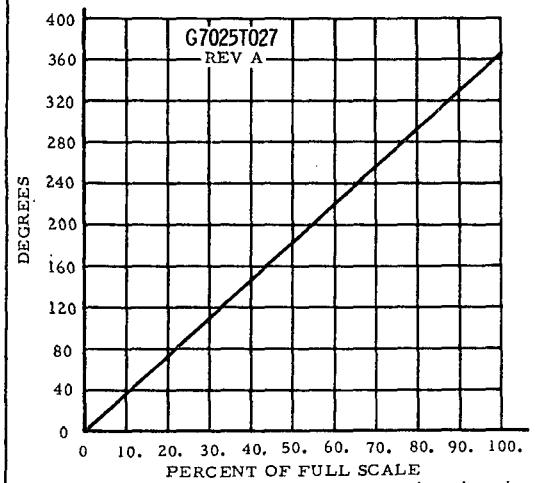
****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 63 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Data: Return: Evaluation: Check: Satisfactory	Data: Return: Evaluation: Check: Anomaly	Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1. 16. 25 (Concluded)	0128	Meter Readout										

Typical G7025T027 Calibration Data:



CURVE FIT DATA

PCT	DEG	PCT	DEG	PCT	DEG	PCT	DEG
1.0	3.808	26.0	94.192	51.0	184.777	76.0	275.361
2.0	7.231	27.0	97.815	52.0	188.400	77.0	278.984
3.0	10.854	28.0	101.459	53.0	192.023	78.0	282.608
4.0	14.478	29.0	105.062	54.0	195.647	79.0	286.231
5.0	19.101	30.0	106.686	55.0	199.270	80.0	289.854
6.0	21.724	31.0	112.309	56.0	202.893	81.0	293.478
7.0	25.348	32.0	115.933	57.0	206.517	82.0	297.101
8.0	28.971	33.0	119.556	58.0	210.140	83.0	300.724
9.0	32.595	34.0	123.179	59.0	213.764	84.0	304.348
10.0	36.218	35.0	126.003	60.0	217.387	85.0	307.971
11.0	39.641	36.0	130.426	61.0	221.010	86.0	312.595
12.0	43.463	37.0	134.049	62.0	224.634	87.0	315.218
13.0	47.066	38.0	137.673	63.0	228.257	88.0	318.841
14.0	50.711	39.0	141.296	64.0	231.880	89.0	322.465
15.0	54.365	40.0	144.920	65.0	235.504	90.0	326.088
16.0	57.968	41.0	148.543	66.0	239.127	91.0	329.711
17.0	61.382	42.0	152.166	67.0	242.750	92.0	333.333
18.0	65.203	43.0	155.790	68.0	246.374	93.0	336.958
19.0	68.828	44.0	159.413	69.0	249.997	94.0	340.591
20.0	72.452	45.0	163.036	70.0	253.621	95.0	344.306
21.0	76.075	46.0	166.660	71.0	257.244	96.0	347.828
22.0	79.698	47.0	170.283	72.0	260.867	97.0	351.452
23.0	83.322	48.0	173.908	73.0	264.491	98.0	355.075
24.0	86.975	49.0	177.530	74.0	268.114	99.0	356.698
25.0	90.569	50.0	181.153	75.0	271.737	100.0	362.322

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

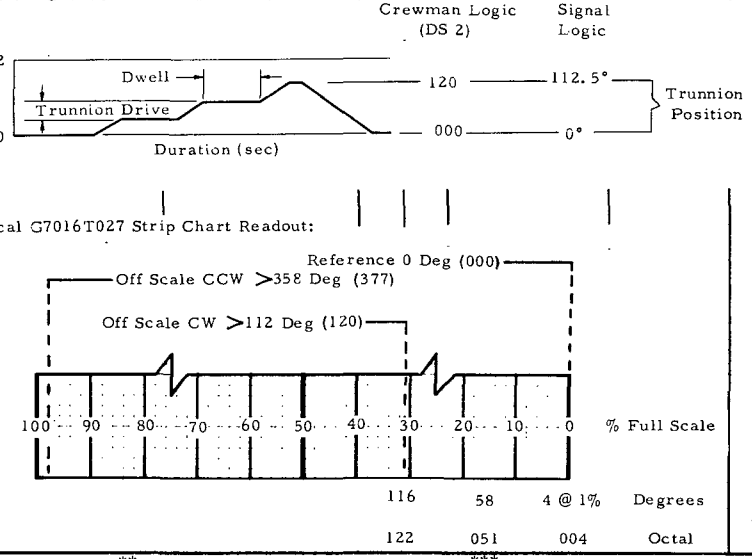
*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 64 of 83)

Operation Step Number*	Recorder Number	Measurement Name, Number, and Signal	Telemetry Assignment Channel	Function**	Frequency***	Range and Dimension of Variables	Limits of Concern	Satisfactory / Anomaly Check	Remarks****	See Contingency Plan Number	Remarks
O 1.16.26		Posti - Exp T027, Trunnion Info G7016T027	WP1O045A01H143	A	C	Range: 0 to 360° Read: 0 to 112.5°	CW = > 112° CCW => 358°		N and Ā		Console Logic: See devices 0138 and 3003.
	3003	Typical G7016T027 Measurement:							Trunnion Motor Drive Rate = 4 °/sec Refer to O 1.16.35		Trunnion Correlation Scale
		Typical G7016T027 Strip Chart Readout:									



Vdc	Bit	Deg	Octal
0	0	0	000
0.3	16	22.5	020
0.6	32	45.0	040
0.9	48	67.5	060
1.3	64	90.0	100
1.6	80	112.5	120

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

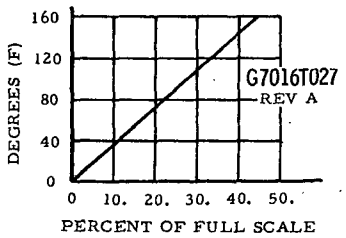
**** R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 65 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.26 (Concluded)	0138	Meter Readout										

Typical G7016T027 Calibration Data:



CURVE FIT DATA

PCT	DEG	PCT	DEG	PCT	DEG	PCT	DEG
1.0	3.500	9.0	32.413	17.0	61.317	25.0	90.221
2.0	7.122	10.0	36.026	18.0	64.530	26.0	93.835
3.0	10.735	11.0	39.039	19.0	68.543	27.0	97.648
4.0	14.348	12.0	43.262	20.0	72.156	28.0	101.061
5.0	17.061	13.0	46.865	21.0	75.769	29.0	104.674
6.0	21.374	14.0	50.478	22.0	79.382	30.0	108.287
7.0	25.187	15.0	54.478	23.0	82.993	31.0	111.900
8.0	28.800	16.0	57.704	24.0	86.608	32.0	115.513

* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
D - Discrete
(Specified number of times)

**** R - Real Time
N - Near/Real Time
A - All Time

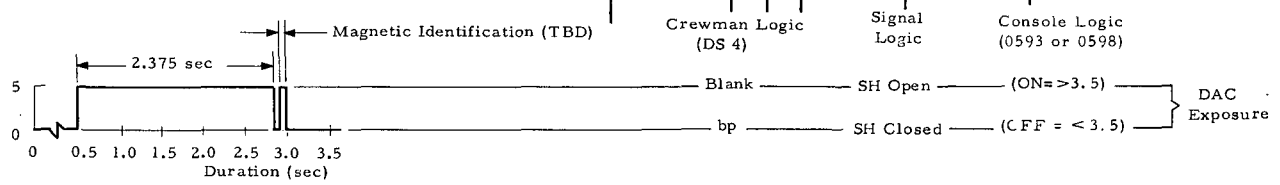
ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 66 of 83)

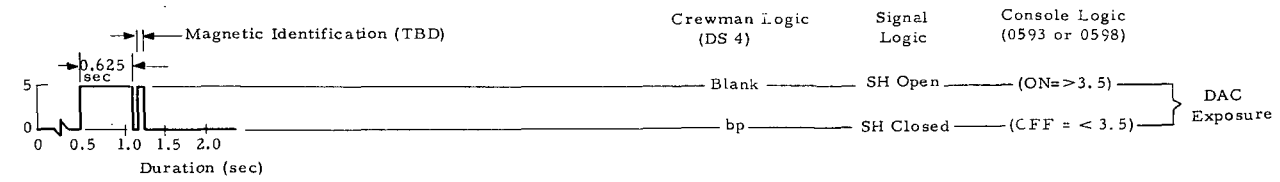
Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Evaluation: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.27	TBS	Event - Exp T027, Camera Exposure K7309T027	WP1C045A02HI45	A	I	Range: 0 or 5 Vdc Read: 0 or 5 Vdc	0 to 5 Vdc			N and $\bar{A}$		Strip chart readout (3004) is identical to signal profile.

Typical K7309T027 Measurement:

FOV Positions 0 and 1



FOV Positions 2 through 5



* P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

** E - Event
H - Housekeeping
A - Analog
D - Digital

*** C - Continuous
I - Intermittent
$\bar{D}$ - Discrete
(Specified number of times)

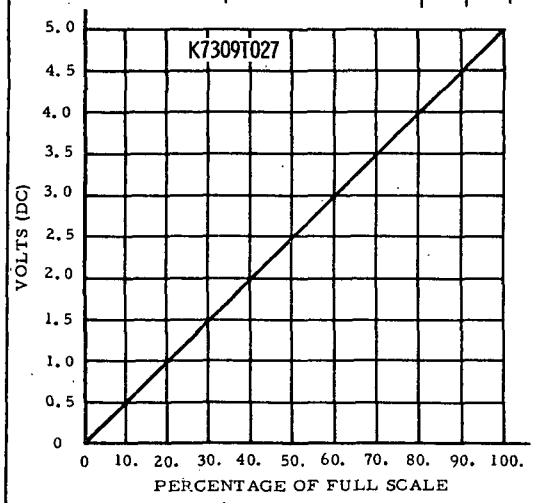
**** R - Real Time
N - Near/Real Time
$\bar{A}$ - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 67 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Remarks
O 1.16.27 (Concluded)	0593 or 0598	Meter Readout										

Typical K7309T027 Calibration Data:



CURVE FIT DATA

PCT	VOLTS	PCT	VOLTS	PCT	VOLTS	PCT	VOLTS
1.0	0.05000	26.0	1.30000	51.0	2.55000	76.0	3.80000
2.0	0.10000	27.0	1.35000	52.0	2.60000	77.0	3.85000
3.0	0.15000	28.0	1.40000	53.0	2.65000	78.0	3.90000
4.0	0.20000	29.0	1.45000	54.0	2.70000	79.0	3.95000
5.0	0.25000	30.0	1.50000	55.0	2.75000	80.0	4.00000
6.0	0.30000	31.0	1.55000	56.0	2.80000	81.0	4.05000
7.0	0.35000	32.0	1.60000	57.0	2.85000	82.0	4.10000
8.0	0.40000	33.0	1.65000	58.0	2.90000	83.0	4.15000
9.0	0.45000	34.0	1.70000	59.0	2.95000	84.0	4.20000
10.0	0.50000	35.0	1.75000	60.0	3.00000	85.0	4.25000
11.0	0.55000	36.0	1.80000	61.0	3.05000	86.0	4.30000
12.0	0.60000	37.0	1.85000	62.0	3.10000	87.0	4.35000
13.0	0.65000	38.0	1.90000	63.0	3.15000	88.0	4.40000
14.0	0.70000	39.0	1.95000	64.0	3.20000	89.0	4.45000
15.0	0.75000	40.0	2.00000	65.0	3.25000	90.0	4.50000
16.0	0.80000	41.0	2.05000	66.0	3.30000	91.0	4.55000
17.0	0.85000	42.0	2.10000	67.0	3.35000	92.0	4.60000
18.0	0.90000	43.0	2.15000	68.0	3.40000	93.0	4.65000
19.0	0.95000	44.0	2.20000	69.0	3.45000	94.0	4.70000
20.0	1.00000	45.0	2.25000	70.0	3.50000	95.0	4.75000
21.0	1.05000	46.0	2.30000	71.0	3.55000	96.0	4.80000
22.0	1.10000	47.0	2.35000	72.0	3.60000	97.0	4.85000
23.0	1.15000	48.0	2.40000	73.0	3.65000	98.0	4.90000
24.0	1.20000	49.0	2.45000	74.0	3.70000	99.0	4.95000
25.0	1.25000	50.0	2.50000	75.0	3.75000	100.0	5.00000

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D - Discrete (Specified number of times)

****R - Real Time
N - Near/Real Time
A - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 68 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variablee	Data: Return: Limits of Concern	Evaluation: Check: Satisfactory	Evaluation: Check: Anomaly	Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.28	TBS	Voltage - Instpu Bus A +5 Vdc M513-514	WP1H114A01LC08	A/H	C	Range: 0 to 6.5 Vdc Read: 0 to 5.1 Vdc	4.95 to 5.25 Vdc			N and Ā		
O 1.16.29	TBS	Voltage - Instpu Bus B +5 Vdc M522-514	WP1B139A30LT08	A/H	C	Range: 0 to 6.5 Vdc Read: 0 to 5.1 Vdc	4.95 to 5.25 Vdc			N and Ā		
O 1.16.30	0517	Volt - PDCS, OWS Bus No. 1 M7002-440	WP1B050A21LH05	A/H	C	Range: 0 to 35 Vdc Read: 24 to 30 Vdc	20 to 33 Vdc			N and Ā		
O 1.16.31	TBS	Cur - PDCS, OWS Bus No. 1 M7004-440	WP1B074A09HE43	A/H	C	Range: 0 to 140 A Read:	13 to 46 A			N and Ā		
O 1.16.32	0527	Volt - PDCS, OWS Bus No. 2 M7003-440	WP1B010A21LH05	A/H	C	Range: 0 to 35 Vdc Read: 24 to 30 Vdc	21 to 33 Vdc			N and Ā		

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 69 of 83)

Operation Step Number*	Recorder Number	Data: Return: Measurement Name, Number, and Signal	Data: Return: Telemetry Assignment Channel	Data: Return: Function**	Data: Return: Frequency***	Data: Return: Range and Dimension of Variables	Data: Return: Limits of Concern	Data: Evaluation: Check: Satisfactory	Data: Evaluation: Check: Anomaly	Data: Evaluation: Remarks****	Contingencies: See Contingency Plan Number	Contingencies: Remarks
O 1.16.33	TBS	Cur - PDCS, OWS Bus No. 2		A/H	C	Range: 0 to 140 A	13 to 46 A			N and Ā		
		M7005-440	WP1B034A01HD41			Read:						
O 1.16.34	TBS	Event-Elapsed Time (Coarse)		E	C	Range: LSB = 1/8 sec; 24 bit word.				N and Ā		
		K502-512	WP1A124A04D107 WP1A045A03D107 WP1A046A03D107 WP1A049A03D107			Read:						
O 1.16.35	Recorded Photometer Systems Signals (Composite):											

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**E - Event
H - Housekeeping
A - Analog
D - Digital

***C - Continuous
I - Intermittent
D̄ - Discrete
(Specified number of times)

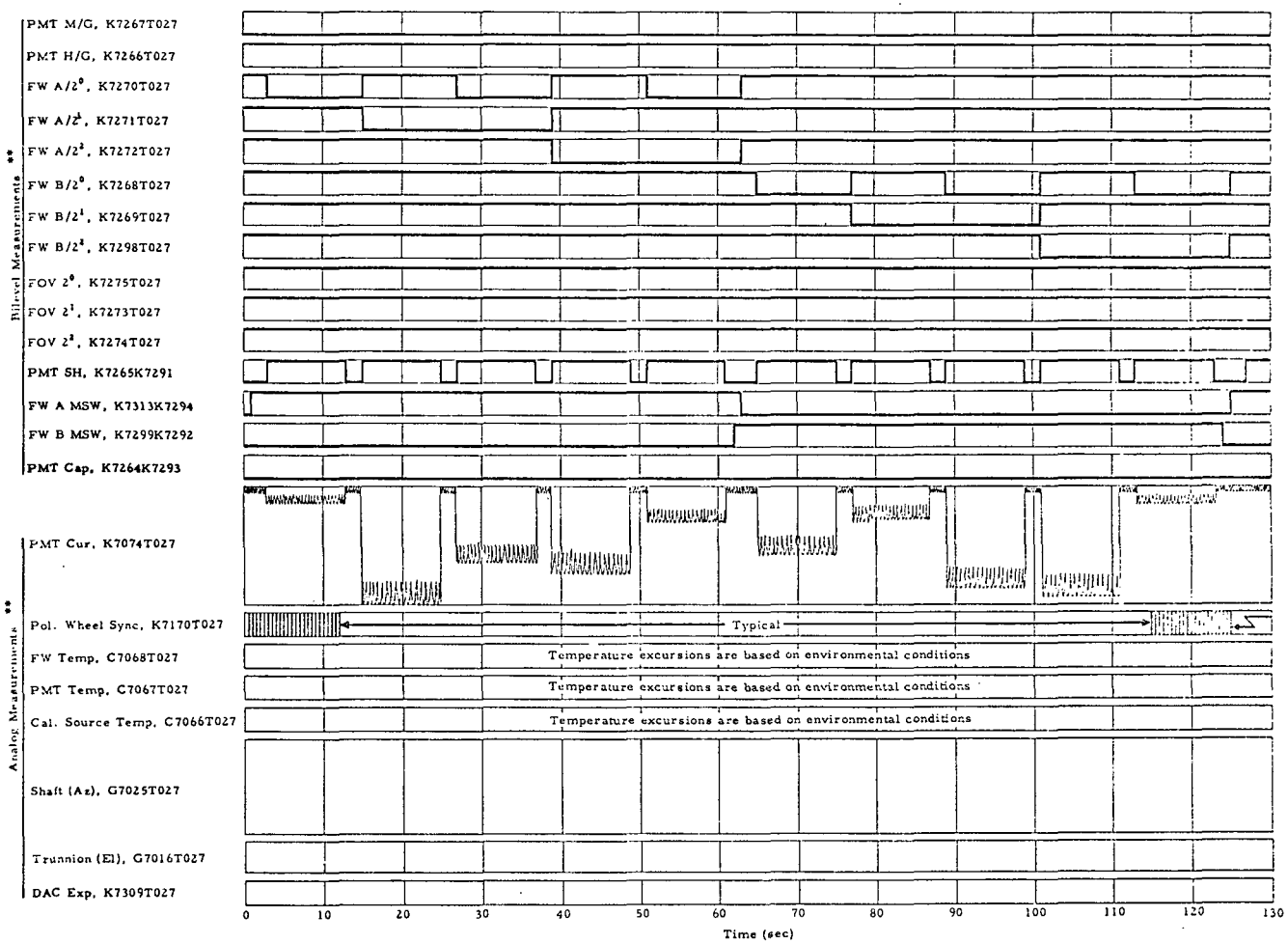
****R - Real Time
N - Near/Real Time
Ā - All Time

ASTN-72-1-OT (Jan 72)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 70 of 83)

Operation Step Number*
O 1.16.35.1

MODE 0, CALIBRATION

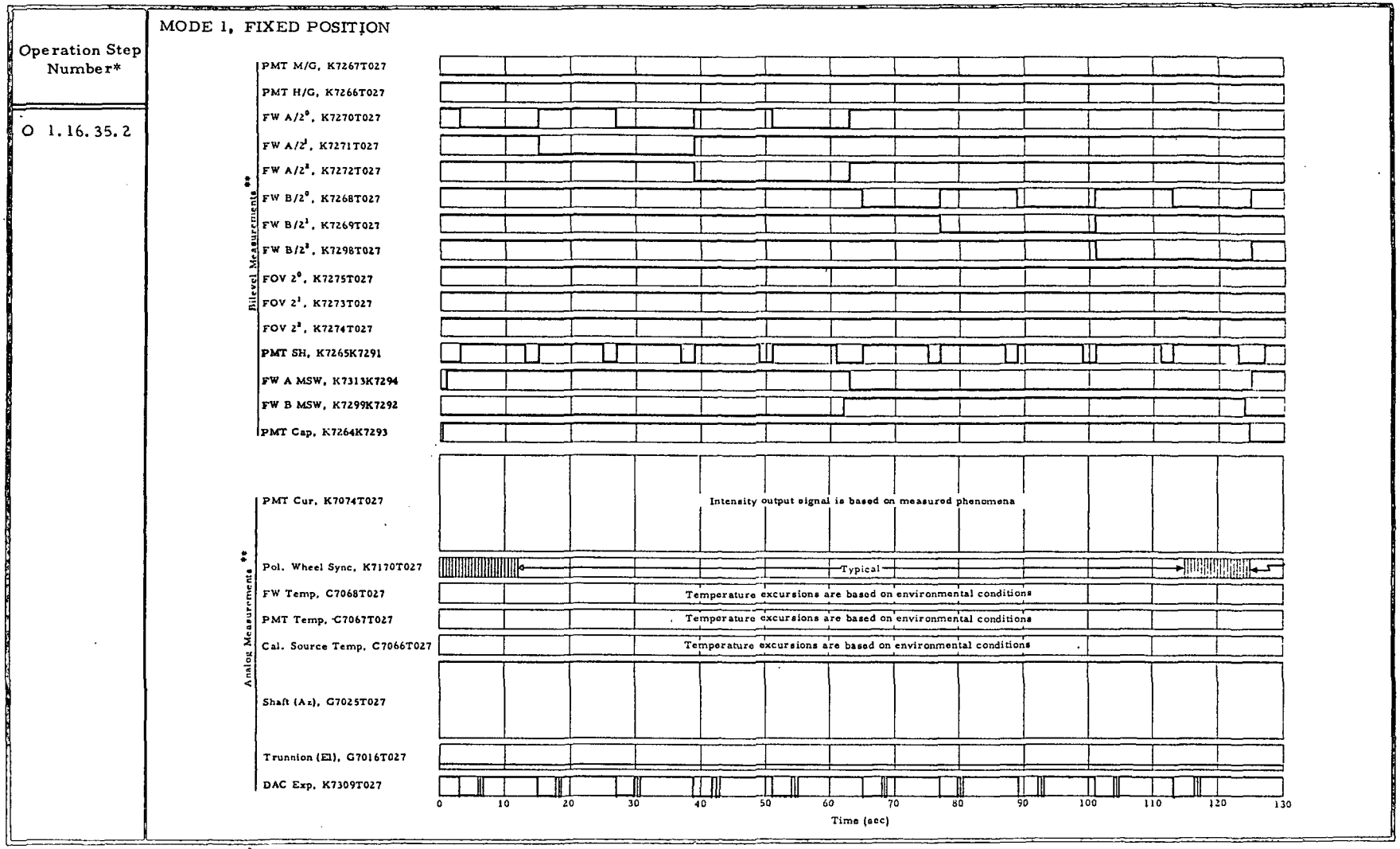


*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 71 of 83)

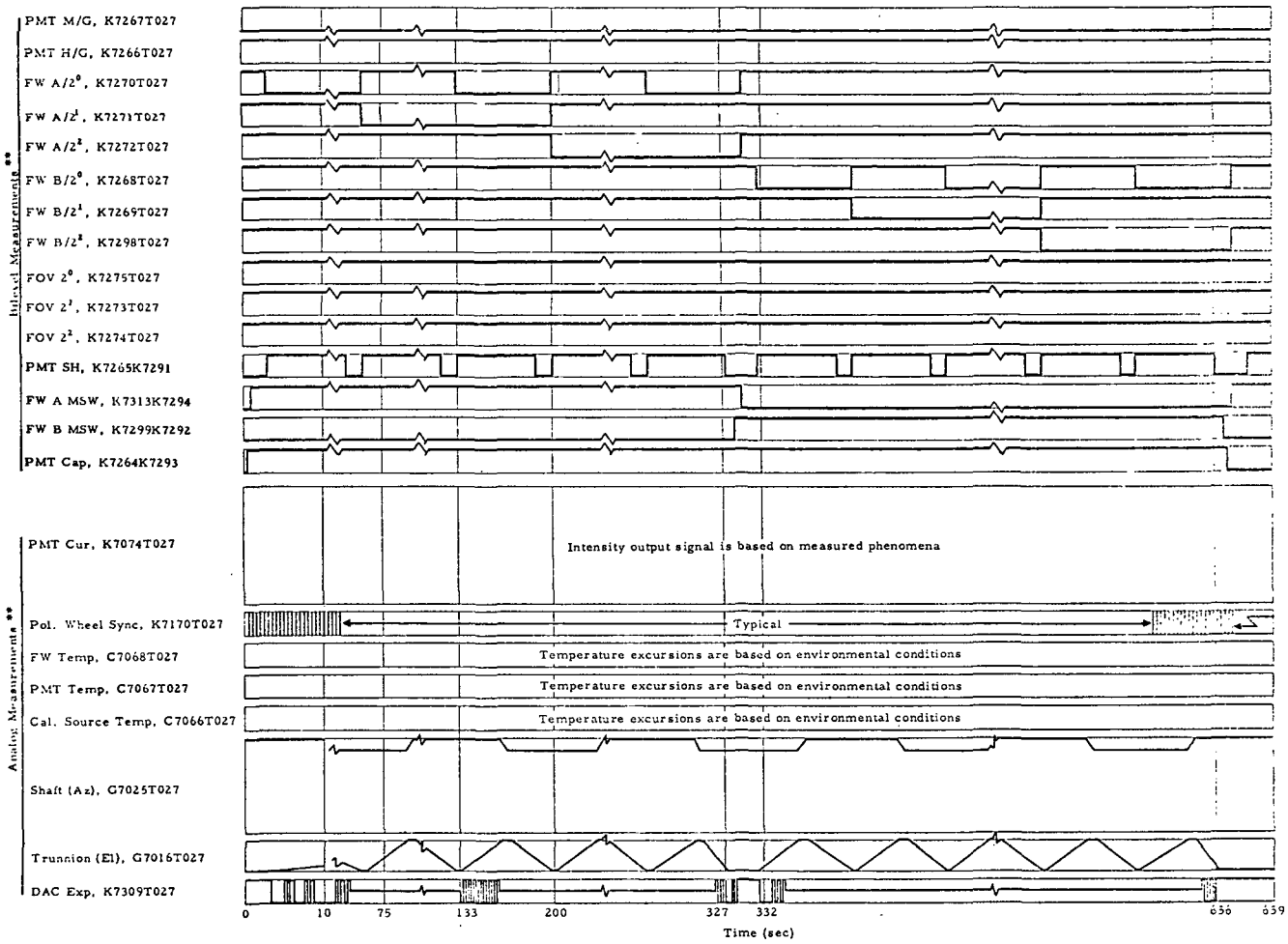


*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 72 of 83)

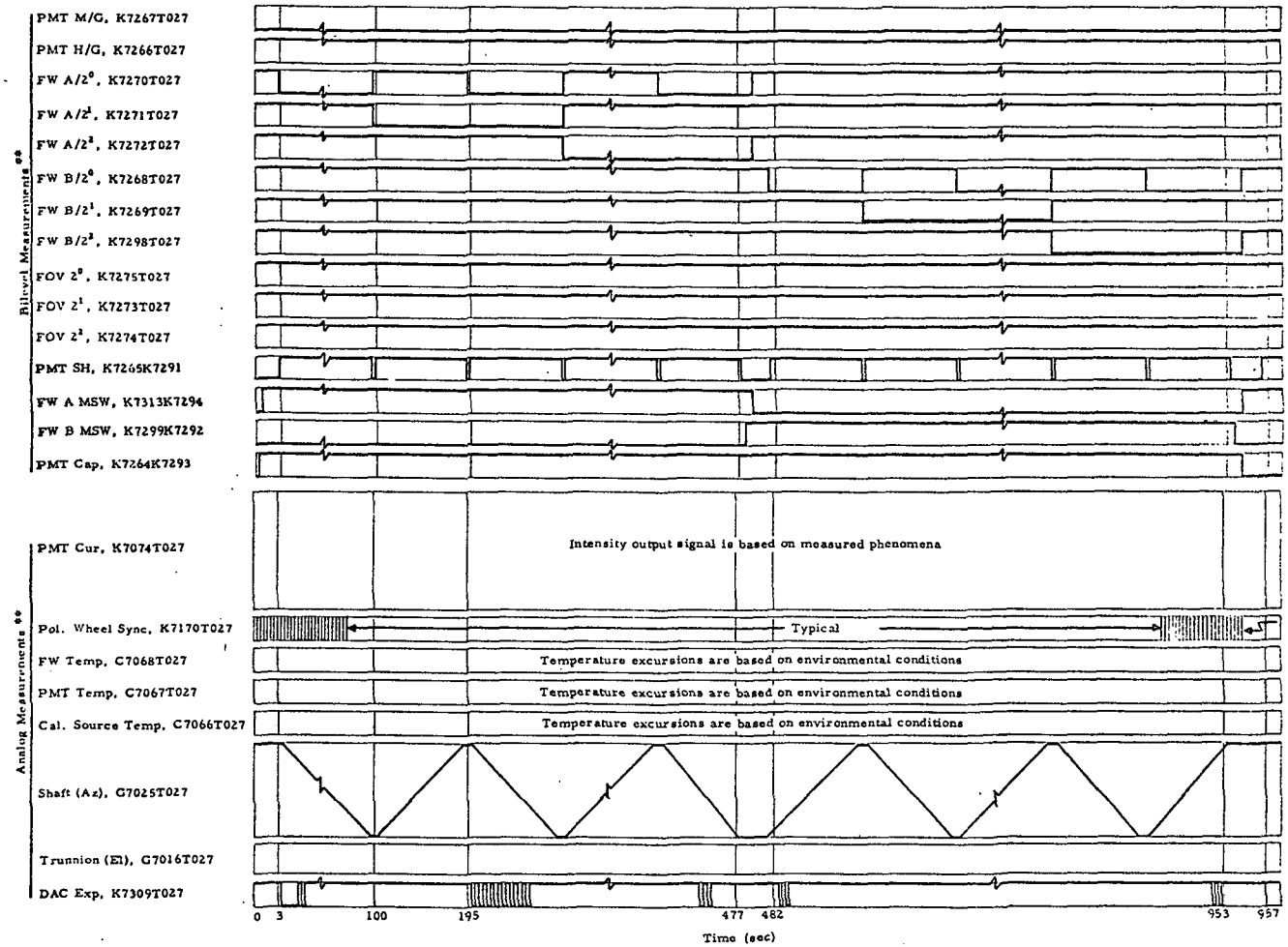
Operation Step Number*	MODE 2, VERTICLE CIRCLE
O 1.16.35.3	

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 73 of 83)

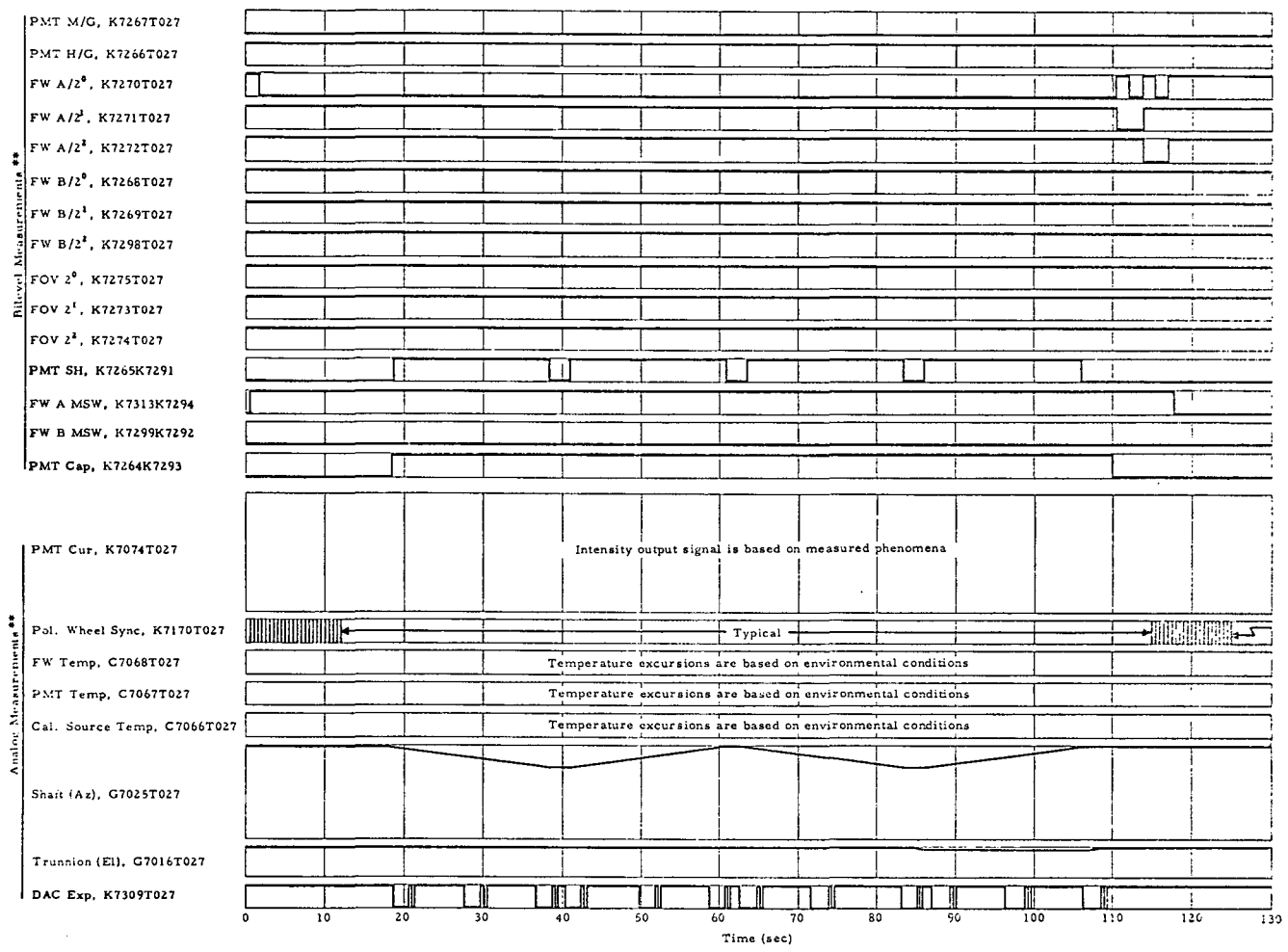
Operation Step Number*	MODE 3, ALMUCANTER
O 1.16.35.4	

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 74 of 83)

Operation Step Number*	MODE 4, LIMITED SKY MAPPING
O 1.16.35.5	

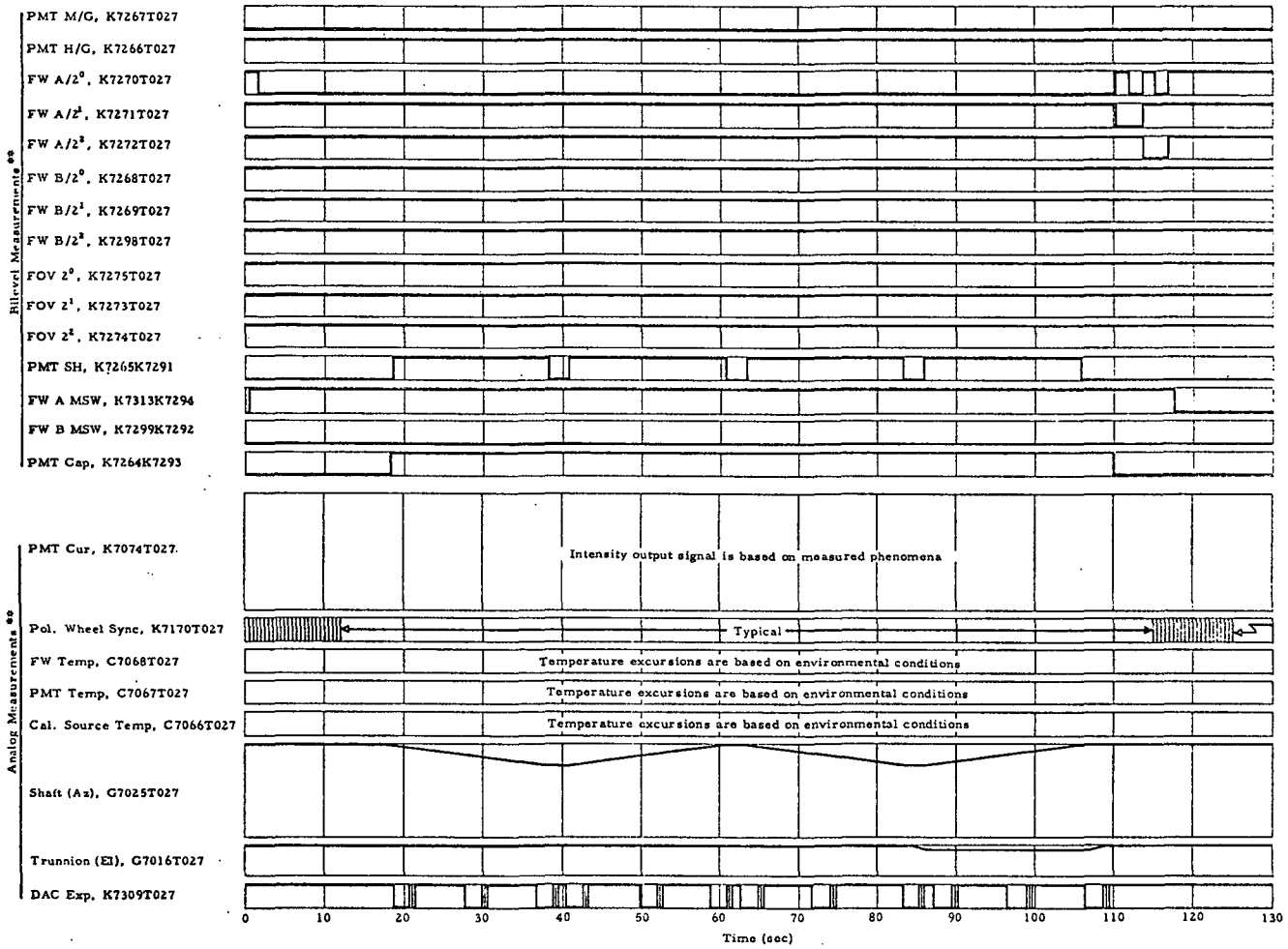
*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurements Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 75 of 83)

Operation Step Number*	MODE 5, ALL SKY MAPPING
O 1.16.35.6	



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

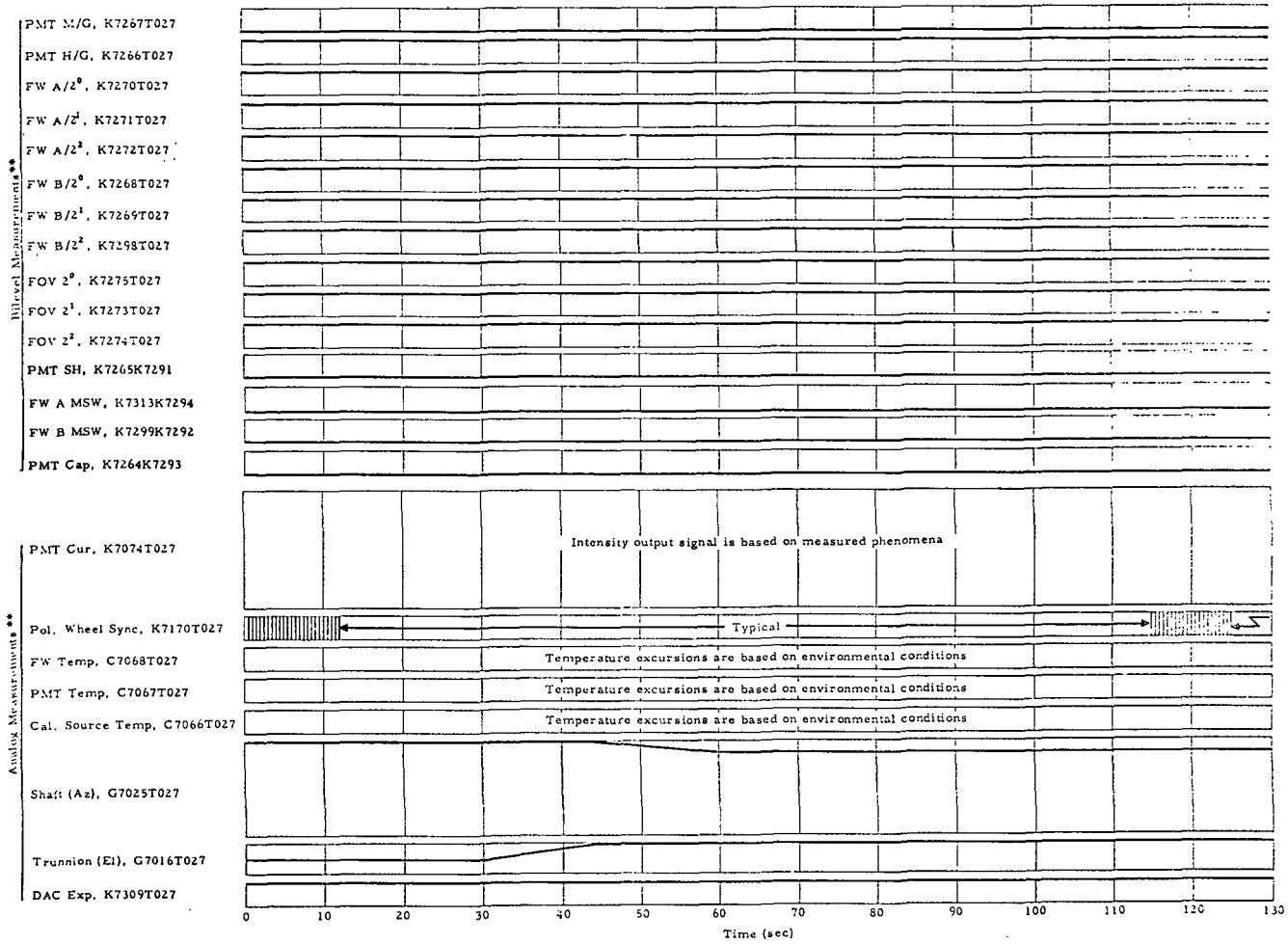
**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 76 of 83)

MODE 6, STOWAGE POSITION RETURN

Operation Step Number*
O 1.16.35.7



*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**Measurement Nos. are defined for SAL 2 (measurement nos. for SAL 1 are similar).

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 77 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T = TBD min for all Skylab Missions		Retract experiment into OWS:				
T 1.0	CDR	Commence photometer system retraction. Note: When operating at the +Z SAL, the photometer should be retracted while the OA is in the earth's shadow.				This procedure may be used to retract the Photometer System at either SAL.
T 1.1		Setup automatic programmer switches for Mode 6 operation.				See program summary sheet for Operation Step No. O 1.6.19. Don headset if desired.
T 1.2		Position PROGRAM sw - START (mom)				S13
T 1.3		PROGRAMMER on lt - on (verify) Wait until PROGRAMMER ON LIGHT - OFF before proceeding.				
		Common Control Panel				
T 1.4		Verify SHAFT ind - 040 (octal)				DS-1
T 1.5		Verify TRUNNION ind - 000 (octal) Note: Perform Operation Step No. T 1.6 only if photometer system is to be removed from SAL immediately.				DS-2
T 1.6		Move CAMERA SHUTTER sw to OPEN/CLOSE (mom) 20 times (10 frames). Verify that CAMERA SHT ind - bp.				
T 1.7		Position T027/S073 POWER sw - OFF.				S1

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 78 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T 1.8		Experiment M-151 operation: (if required): • High intensity lt SYS 1 & 2 HIGH • POWER - ON (3 min warm up required) • DAC cb - on				
T 1.9		Release extension mechanism preload. Note: If seven extension rods were used to deploy photometer system, rotate crank handle ccw (approximately 37 times) until an abrupt torque increase is felt. Warning Extension rods may be hot or cold, do not touch the rods. Caution Do not stand directly behind extension rods, until after the preload is removed.				This action retracts the extension rods approximately 3 in. as well as removing the load from the extension rods. Don utility gloves if desired (stowage location S912, S924, S934, and W718 through W731.
T 1.10		Press rod LATCH to open position and retract extension rod C until the rod handle attachment mark is visible in front of the tube brake.				
T 1.11		Fasten tube brake to extension rod.				
T 1.12		Remove crank handle and stow on top of photometer canister.				
T 1.13		Remove extension rod handle from top of photometer canister and attach to extension rod C.				
T 1.14		Release tube brake.				
T 1.15		Retract rod until handle attachment mark is visible in front of tube brake.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 79 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T 1.16		Fasten tube brake on extension rod (B).				
T 1.17		Remove extension rod (rotate handle ccw) and stow.				
T 1.18		Remove extension rod handle and attach to next rod to be retracted (B).				
T 1.19		Repeat Operation Step Nos. T 1.14 through T 1.18. Retract and remove remaining B extension rods.				
T 1.20		Unfasten tube brake from extension rod A.				
T 1.21		Retract extension rod and maintain constant retraction force on the rod, and clamp tube brake to rod A.				
T 1.22		Close SAL door (SAL door closing procedures - decal if photometer system will be stowed immediately.				
T 1.23		Release rod LATCH and tube brake.				
T 1.24		Remove the extension rod (rotate handle CCW) and stow.				
T 1.25		Remove extension rod handle from extension rod A and install on top of canister.				
T 1.26		Verify that rod LATCH is engaged in most support tube slot.				
T 1.27		Experiment M-151 16mm DAC and high intensity light - off.				
T 1.28		Record on tape and in logbook the following: • Date • Retraction time • Any pertinent comments/data.				
T 1.29		S/I RECORD/OFF - OFF (mom) (green advisory lt - off).				Disconnect headset (as desired).

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE (Sheet 80 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T = TBD min for all Skylab Missions		Commence experiment termination.				
T 2.0	CDR	Start experiment deactivation, removal and stowage.				
T 2.1		Notify crew and ground that the photometer system is to begin.				Don headset (if desired).
T 2.2		Experiment M-151 operation (if required). • Hi intensity lt SYS 1 & 2 HIGH POWER - ON (3 min warm up required) • DAC pb - on.				
T 2.3		Disconnect SAL PWR and SAL INST cable from OWS outlets, then the photometer panel.				F591
T 2.4		Stow cables and close stowage container. Note: When removing from -Z SAL, immediately install PS END plate on Photometer upon removal and stow until temperature stabilizes.				
T 2.5		If experiment deactivation occurs from the anti-solar SAL, obtain PS END PLATE and restrain near SAL.				
T 2.6	OPR	Remove photometer system canister from SAL (see SAL experiment removal procedures - decal), attach end plate and restrain on F591 stowage container lid.				Two crewmen required.
T 2.7	CDR	Remove tripod support bracket from the canister, and stow on top of canister assembly.				
T 2.8		Remove tripod and stow.				F569
T 2.9		Experiment M-151 16mm DAC pb and high intensity light - off.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 81 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T 2.10		Wait for temperature stabilization of photometer head inside the canister (60 - 120 min).				Estimated time.
T 2.11		Experiment M-151 operation (if required): • Hi intensity lt SYS 1 & 2 HIGH • POWER - ON (3 min warm up required) • DAC pb - on.				
T 2.12		Release tube brake and detent open.				
T 2.13		Remove extension rod handle from top of photometer canister and attach to extension rod A.				
T 2.14		Remove the extension rod from rack (rotate ccw), align and partically thread into photometer system extension mechanism.				
T 2.15		Press and lock rod LATCH in open position. Caution Do not over torque extension rods. Ensure a firm and snug fit between rod and extension mechanism interface.				
T 2.16		Complete threading of extension rod to photometer system extension mechanism.				
T 2.17		For usage on the (+Z) SAL: proceed to Operation Step No. T 2.19.				
T 2.18		For usage on the (-Z) SAL: remove PS end plate and retain.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 82 of 83)

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T 2.19	OPR	Deploy photometer system head out of the photometer canister.				Two crewmen are required.
T 2.20		Fasten tube brake to extension rod.				
T 2.21		Rotate three mechanism locks to locked position.				
T 2.22		Attach photometer head dust cover to photometer head.				
T 2.23		For (-Z) SAL, remove sunshield cover assembly and install on side of canister.				
T 2.24		Remove photometer system dust cover, restrain, and install the sunshield segment on to the photometer head.				
T 2.25		Attach photometer head dust cover to photometer head.				
T 2.26		Remove film mag DAC and retain near work station.				
T 2.27		Release tube brake from extension rod.				
T 2.28		Release rod LATCH.				
T 2.29		Retract photometer head into canister until extension rod A full retraction mark is visible. Caution If photometer head hangs up during retraction, determine and correct problem before proceeding. Verify that the electrical connector wire bundle is looped inward towards the photometer head.				
T 2.30		Maintain constant retraction force on the rod until the rod LATCH engages.				
T 2.31		Verify rod A LATCH is engaged.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972

TABLE T-III. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT EVALUATION SEQUENCE
(Sheet 83 of 83

Operation Step Number*	Crewman**	Test Procedure	Evaluation (Check One)		See Contingency Plan Number	Remarks
			Satis-factory	Anom-aly		
T 2.32		Remove and stow extension rod and extension rod handle.				
T 2.33		Attach photometer system end plate.				
T 2.34		Stow photometer system canister.				
T 2.35		Experiment M-151 16mm DAC pb and high intensity light - off				F591
T 2.36		Stow film magazine from photometer head camera (See T027/S073 update pad) in drawer F510.				Remove headset (if desired).
T 2.37	CDR	Record photometer system termination time and other pertinent comments in logbook or on tape.				W 742
T 2.38		Stow: Logbook Checklist.				

*P - Preparation
O - Operations
T - Termination
L - Lift-off (Booster)

**CDR - Commander
SPT - Science Pilot
PLT - Pilot
ALL - CDR/SPT/PLT
OPR - Any combination of CDR/SPT/PLT
GND - Ground Personnel

MSFC - One Time Form 17-1 (March 1972)

SECTION VIII.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 1 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
P 2.5	Remove photometer system and restrain on top of stowage container lid.	P25A Stowage container fasteners fail to release.	P25A1 If the F591 stowage container latches are undamaged, loosen/remove cap locking nut and adjustment on arm that attaches to the lid. Use the 9/16-in. deep well socket and ratchet handle from PATK.	The tools are transferred from the stowage containers (E623 and E624) to a tool caddy (PATK) and for a utility belt. Stowage for PATK and utility belt is S909, S921, and S931.
			P25A2 Acquire pry bar from PATK and force the latches open.	
			P25A3 Open F591 storage container lid and continue the experiment preparation.	
		P25B Calfax fasteners that attach the canister to the stowage container fail to release.	P25B1 Use channel lock pliers from PATK, grip black knurled knob, and unscrew CCW until fasteners either release or the Clafax shaft assembly shears.	The Calfax shaft assembly can shear at two places.
			P25B2 Inspect Calfax shaft assembly to determine if the fasteners have released.	The fasteners are released when the spring is fully extended and the shaft can be depressed and then unloaded when released.
			P25B3 If the black knob is sheared from the Calfax shaft assembly, dispose of knob and spring components.	
			P25B4 Attach vice grip pliers to the exposed portion of the shaft and turn CCW until the fasteners either release or the Calfax shaft assembly shears.	
			P25B5 Refer to Contingency Plan P25B2.	
			P25B6 If the Calfax shaft is sheared from the bottom retainer bushing, dispose of shaft component.	

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 2 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P25B7 Obtain 3/32-in. taper punch from PATK, align through upper Calfax shaft assembly guide bracket, and set on top of bottom retainer bushing.	
			P25B8 Obtain ball peen hammer and drive out Calfax retainer by tapping the taper punch.	The Calfax retainer is lost and the shaft assembly cannot be used to attach to the stowage container or canister tripod support bracket (as required).
			P25B9 Remove the canister assembly from the F591 stowage container and continue the experiment preparation.	
			P25B10 If malfunction P25A has occurred and either Contingency Plan P25A1 or P25A2 is implemented, remove all stowed hardware (power and instrumentation cables) and restrain in immediate area.	The top of stowage container F591 cannot be secured using the mechanical latches. Pressure sensitive tape may be used; stowage location: E623 and M144.
			P25B11 Close lid of F591 stowage container and apply 2-in. wide pressure sensitive tape to secure the lid to the container; continue the experiment preparation.	Tape stowage: E623 and M144.
		P25C Calfax fasteners cannot secure the canister to the top of the F591 stowage container.	P25C1 If one or more Calfax fasteners can be engaged to the F591 stowage container pads, continue the experiment preparation.	Screw threads on Calfax shaft or mounting pads may be damaged.
			P25C2 If all Calfax fasteners are failed and cannot be engaged with the pads, secure the canister to the stowage container using short bungees; continue experiment preparation.	Bungee stowage: E621.

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 3 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
		P25D Stowage container guide cones are inhibiting removal of canister.	P25D1 If removal of canister assembly from the stowage container is inhibited or prevented by sticking guide cone assemblies, ensure that the canister is lifted evenly and straight out; continue experiment preparation.	Two crew members are required.
P 2.6	Remove front end plate from canister assembly and attach to T027 END PLATE PS stowage location.	P26A End plate cannot be removed from the canister flange.	P26A1 Observe the eight attaching pivot blocks to determine those that are jamming.	
			P26A2 Use an adjustable jaw wrench from PATK, and torque the jamming pivot blocks as required to release it from the canister.	PATK stowage: refer to Operation Step No. P 2.5, Remarks.
			P26A3 Use the 3/32-in. long taper punch and ball peen hammer from PATK, and drive out pin at jammed attaching pivot block.	
			P26A4 If pivot blocks are still jammed, disassemble affected component using appropriate wrenches from PATK.	
			P26A5 Use a ball peen hammer from PATK, and carefully tap one or more of the end plate guide lands while holding the end plate with the other hand; continue experiment preparation.	
		P26B End plate cannot be stowed on F591 container.	P26B1 Attach end plate to T027 END PLATE PS stowage brackets; secure with 2-in. pressure sensitive tape, and continue experiment preparation.	Tape stowage: E623 and M144.

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 4 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
P 2.7	Release tube brake from launch plug on mechanical control panel and detent open.	P27A Calfax fails to release tube brake; launch plug cannot be removed.	P27A1 Obtain channel lock pliers from PATK, grip knurled knob, unscrew CCW until fasteners either release or strip its threads.	Refer to Operation Step No. P25A1, Remarks. If the Calfax fastener's threads are stripped, the clamping force to hold the extension rods are lost.
			P27A2 If the fasteners do not release, obtain 3/16-in. blade driver and wedge between tube brake pivot arm assemblies; repeat Contingency Plan P27A1, and continue experiment preparation.	
P 2.8	Unscrew, remove, and dispose launch plug.	P28A Launch plug screw threads are binding or frozen.	P28A1 If the launch plug cannot be unthreaded by crew member using hand torque, obtain channel lock pliers from PATK, grip knurled knob, unscrew CCW until plug is removed; continue experiment preparation.	Refer to Operation Step No. P25A1, Remarks.
		P28B Launch plug screw threads are stripped.	P28B1 If the launch plug screw threads are stripped, dispose of launch plug, and inspect mast support tube internal threads.	
			P28B2 If mast support tube threads are stripped, be prepared to terminate the experiment.	Likelihood of extension rod A attaching to the mast support tube is nil.
P 2.10	Remove extension rod A from rack (rotate CCW), align, and partially thread to photometer system extension mechanism.	P210A Extension rod handle fails to attach to rod A.	P210A1 Examine end of extension rod and rod handle assemblies for debris and rod interface seat damage. Remove debris or dress face of extension rod seat using knife from PATK.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 5 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P210A2 Examine rod handle for functional operation of plunger button and pivot latches; examine rod turning pin to determine malfunction.	If pivot latches fail to close after the plunger button is released, the latching tension spring is broken. If rod turning pin is broken, the extension rod end slot cannot be engaged by the pin so that torque can be applied to attach the rod. If the plunger button spring fails, the latches may not be fully engaged on the extension rod slot collar relief. Disassembly of extension rod handle may be accomplished by removing two driver bit screws on the handle (see Contingency Plans P232H1 through P232H12).
			P210A3 If the extension rod handle is inoperable, use the 3/16-in. blade screwdriver in the PATK to release extension rod from the holder. Manually unscrew the rod.	Alternatives to the 3/16-in. blade screwdriver are: • shaft of 1/8-in. Allen bit • shaft of Phillip's driver No. 1 • grip shaft of 11/32-in. combination wrench. All the above tools may be engaged into the rod stem slot, and used in a T-handle fashion.

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 6 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
			P210A4 Use channel lock pliers from PATK to aid in tightening/loosening the connection of the extension rod; continue experiment preparation.	Warning Do not grip the extension rod tube. Grip only the slotted stem section of the rod with pliers. Caution Do not overtighten. Only bring threads up snugly.
		P210B Mast support tube threads are stripped.	P210B1 Terminate the experiment nominally.	Extension rod A cannot be attached to the mast support tube, and the photometer system head cannot be deployed.
		P210C Extension rod A forward stem threads are stripped.	P210C1 Terminate the experiment nominally.	The mast support tube cannot attach to the extension rod, and the photometer system head cannot be deployed.
P 2.11	Press and lock mechanical control panel rod LATCH in open position.	P211A Rod LATCH fails open.	P211A1 Press the rod LATCH to the open position and secure with the thumb latch; continue experiment preparation.	The tension spring is broken and/or disconnected from the rod latch assembly.
		P211B Rod LATCH fails closed.	P211B1 Acquire the mechanical fingers from the PATK, remove the spring, and dispose spring in trash. P211B2 Refer to Contingency Plan P211A1.	The tension spring is wedged between the rod LATCH assembly and the mechanical control panel wall.
		P211C Thumb latch fails open.	P211C1 After pressing rod LATCH down, secure the thumb latch onto the rod LATCH, and continue experiment preparation.	The thumb latch torque spring is broken and will not secure the rod LATCH. The rod LATCH spring

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 7 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
				indirectly applies tension to the thumb latch.
			P211C2 After pressing rod LATCH down, attach a strip of 1-in. pressure sensitive tape on the face of the rod LATCH assembly and secure to the bottom of the thumb guard housing; continue experiment preparation.	The thumb latch torque spring is broken and will not secure the rod LATCH. The rod LATCH spring is not indirectly applying tension to the thumb latch. Tape storage: E623 and M144.
P 2.12	Complete threading of extension rod A to photometer system extension mechanism.	P212A Extension rod A index pins bent out of alignment.	P212A1 Determine what extension rod indexing pins are bent out of alignment. P212A2 Acquire slip joint pliers from the PATK and bend pins back into alignment; continue experiment preparation.	
		P212B Extension rod A index pins are lost.	P212B1 Ensure that at least one index pin is attached to extension rod before interfacing it to the mast support tube; continue experiment preparation.	One index pin attached to the extension rod is sufficient to index the rod to the mast support tube.
		P212C Extension rod A forward stem section shears from inner rod.	P212C1 Remove outer extension rod and stow in rod stowage rack. P212C2 Remove rod handle from extension rod and stow handle on canister. P212C3 Acquire vice grip from PATK and attach to stem section. P212C4 Pull stem section for retraction of photometer head and release the rod LATCH. P212C5 Ensure that the rod LATCH is engaged into the mast support tube slot.	

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 8 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
			P212C6 Unscrew the stem section CCW and dispose of it in the trash container.	Trash container stowage: F568
			P212C7 Obtain 3/4-in. pressure sensitive tape and retain near the canister rod rack assembly.	Tape stowage: E623 and M144.
			P212C8 Push the extension rod against the forward rack stop.	
			P212C9 Wrap several turns of tape about the outer rod section adjacent to back side of the mechanical control panel rod rack, and terminate the experiment nominally.	This will prevent the extension rod from inadvertently moving out of the rod rack. The backup hardware extension rod A can be resupplied on the SLM-2 mission. If the extension rod is resupplied to the experiment, a 1 1/2-in. tube cutter should be included on the SLM-2 mission. The tube cutter would be used to remove the outer rod from the inner rod. This permits the crewman to access the inner rod assembly and disconnect the failed rod from the mast support tube.
		P212D Extension rod A inner rod shears.	P212D1 Refer to Contingency Plans P212C1 through P212C9.	
		P212E Extension rod A outer rod becomes fractured or cracked.	P212E1 Determine extent of outer rod failure.	
			P212E2 If outer rod is fractured (two separate sections), hold the forward section while turning the inner rod CCW	P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 9 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			until it partially releases from the mast support tube. P212E3 When the rod alignment pins (five small) clear the mast support tube slot, engage the rod LATCH into the slot. P212E4 Complete removal of inner rod by turning it CCW, stow extension rod in canister rod stowage rack. P212E5 Remove extension rod handle from the extension rod and stow handle on canister. P212E6 Obtain 2-in. pressure sensitive tape and wrap several turns about the rod fracture line; terminate the experiment nominally.	Ignore taping the rod if it is only cracked. Refer to Operation Step No. P212C9, Remarks.
		P212F Extension rod A end plugs become unbonded.	P212F1 Partially remove extension rod, ensure that the rod alignment pins (five small) clear the mast support tube slot before releasing rod LATCH. P212F2 Verify that rod LATCH is engaged in mast support tube slot. P212F3 Remove extension rod from mast support tube and stow in rod stowage rack. P212F4 Remove extension rod handle from extension rod and stow handle on canister; terminate the experiment nominally.	Refer to Operation Step No. P212C9, Remarks.

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 10 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
		P212G Extension rod A outer tube severly dented.	P212G1 Determine the severity of the dent.	
			P212G2 If the outer rod tubular section is krimped or deformed so that either O-ring seal damage or binding could occur when deploying the photometer head out of the canister, do not deploy the photometer head.	
			P212G3 Refer to Contingency Plans P212F1 through P212F4.	Refer to Operation Step No. P212C9, Remarks.
			P212G4 If the outer rod tubular section is not severly dented and no O-ring seal damage is expected when deploying the photometer head, continue experiment preparation.	
		P212H Extension rod A outer tube gouged.	P212H1 Obtain knife from PATK and carefully draw the blade over the the gouged area. Using a scraping action, to remove all burrs; continue experiment preparation.	
		P212I Extension rod A aft stem section retaining pin shears from inner rod.	P212I1 Remove extension rod handle and stow on canister assembly.	
			P212I2 Determine the nature and extent of stem section damage. If the tip of the inner rod is lost, refer to Contingency Plan P212J1.	
			P212I3 If retaining pin is lost or sheared, and the pin hole is undamaged, insert a 7/64-in. Allen driver bit into pin hole and attach the inner rod to the aft stem section.	Allen bit stowage: E624

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 11 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P212I4 Obtain 3/4-in. pressure sensitive tape and attach several wraps of tape to Allen bit and stem section.	Tape stowage: E623 and M144.
			P212I5 Obtain channel lock pliers from PATK and grip about the stem section; turn inner rod CCW while holding outer rod.	
			P212I6 Partially disconnect the extension rod from the mast support tube.	
			P212I7 Ensure that the rod alignment pins (five small) clear the mast support tube slot and release the rod LATCH.	
			P212I8 Verify rod LATCH engaged in mast support tube slot; continue turning inner rod CCW until it releases from the mast support tube.	
			P212I9 Remove channel lock pliers, tape from Allen bit, and stow the rod assembly in the rod stowage rack, and tape the stem end to the extension rod.	
			P212I10 Refer to Contingency Plans P212C7 through P212C9.	Refer to Contingency Plan P212C9, Remarks.
		P212J Extension rod A aft stem section inner rod shears at retaining pin hole.	P212J1 Remove extension rod handle and stow on canister assembly.	
			P212J2 Determine the nature and extent of stem section damage. If only the pin is sheared from the inner rod, refer to Contingency Plans P212I3 through P212I10. If the tip of the inner rod is lost, refer to Contingency Plans P212C1 through P212C9.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 12 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
P 2.13	Deploy photometer system head out of the canister.	P213A Electrical cable is binding.	P213A1 Obtain portable Hi-intensity light and connect cable to HI POWER ACCESSORY OUTLET 1 or 2 at panel 551. P213A2 Turn on portable light and inspect forward end of canister opening for binding electrical cables between the photometer head and the cable disconnect. P213A3 Have assisting crew member move the extension rod forward and backward until cable frees itself. P213A4 Continue experiment preparation. P213A5 If cable does not free itself, retract the photometer head and terminate the experiment nominally.	Light stowage: F521
		P213B UXM bars and links are binding.	P213B1 Refer to Contingency Plan P213A1. P213B2 Turn on portable light and inspect forward end of canister opening for binding bars and links. P213B3 Have assisting crew member move the extension rod forward and backward until the components free themselves. P213B4 Continue experiment preparation. P213B5 If the bars and links cannot be freed, retract the photometer head and terminate the experiment nominally.	P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 13 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
P 2.14	Clamp tube brake to A rod.	P214A Calfax fasteners will not engage.	P214A1 Obtain vice grip pliers from PATK and attach to top of both pivot arm assemblies when it is desired to secure the extension rod. P214A2 Release the vice grip pliers from the pivot arm assemblies when it is desired to move the extension rod; continue experiment preparation.	
P 2.20	Remove photometer head forward dust cover and attach to T027 PS DUST COVER STOWAGE bracket.	P220A Calfax fasteners will not release.	P220A1 Refer to Contingency Plan P27A1; continue experiment preparation.	The capability to firmly attach the dust cover to the photometer is lost.
		P220B Dust cover cannot be stowed on F591 container.	P220B1 Refer to Contingency Plan P26B1; continue experiment preparation.	
P 2.22	For usage on (-Z) SAL: remove forward sunshield segment and install aft dust covers on sunshield segment.	P222A Sunshield Calfax fasteners will not release aft sunshield segment.	P222A1 Refer to Contingency Plan P27A1; continue experiment preparation.	The PI's must concur with Contingency Plan P222A1 before it is implemented. The capability to attach the forward sunshield segment using the Calfax fasteners is lost.
		P222B Dust cover Calfax fasteners will not release from canister assembly.	P222B1 Ignore the dust covers; continue experiment preparation.	
P 2.25	Verify that photometer head attaching screws (two knurled knobs) are tight and positively latched (latch retained in locking grooves).	P225A Thumb latch not retained in lock groove position.	P225A1 Turn photometer head attaching screw knob CW until firm resistance is sensed and pivot thumb latch into knob's lock groove position; continue experiment preparation.	
P 2.26	Verify gear alignment of FW's.	P226A FW's not aligned (escapement alignment mark not perpendicular to FW motor drive shaft).	P226A1 Determine if the Geneva mechanism escapement alignment marks are perpendicular to the FW motor drive shaft.	P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 14 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
			P226A2 If the escapement alignment marks are not perpendicular to the FW motor drive shaft, rotate the FW motor shaft so that the escapement can clear the cam and rotate freely.	
			P226A3 Rotate the escapement so that an alignment mark is perpendicular to the FW motor shaft, then rotate the FW motor shaft so that the index mark is aligned with the escapement index mark; continue experiment preparation.	
		P226B FW's not aligned (escapement alignment mark is perpendicular to FW motor drive shaft).	P226B1 Refer to Contingency Plan P226A1.	
			P226B2 If the escapement alignment marks are perpendicular to the FW motor drive shaft, rotate the FW motor shaft so that the index mark is aligned with the escapement index mark; continue experiment preparation.	
P 2.27	Rotate the three orientation mechanism locks to the unlocked position.	P227A Trunnion locks fail to open.	P227A1 Determine if debris has fouled the movement of the knob lock mechanism, remove debris and unlock trunnion locks.	
			P227A2 Obtain channel lock pliers from PATK, grip appropriate trunnion knob, and rotate CCW until lock detents open; continue experiment preparation.	
		P227B Trunnion locks fail to detent open.	P227B1 Rotate trunnion locks to detent open position.	
			P227B2 Obtain ship joint pliers, cutter pliers, and safety wire from PATK.	Safety wire stowage: E623. P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 15 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P227B3 Using a length of safety wire, double wrap the trunnion locks in the open position, attach, twist, and trim the safety wire at the yoke assembly; continue experiment preparation.	
		P227C Shaft lock fails to open.	P227C1 Determine if the T-pin is bent around the pin nut castelation slots, pry T-pin loose with 3/16-in. drive blade and rotate shaft lock 90° (T-pin aligned with deployment axis of photometer UXM); continue experiment preparation.	
P 2.29	Retract the photometer head into the canister until extension rod A full retraction mark is visible.	P229A Electrical cable is binding.	P229A1 Refer to Contingency Plans P213A1 through P213A5.	
		P229B UXM bars and links are binding.	P229B1 Refer to Contingency Plans P213B1 through P213B5.	
		P229C Full retraction mark on extension rod A cannot be seen.	P229C1 Refer to Contingency Plans P213A1 through P213A4.	The mast support tube slot cannot be aligned to the rod LATCH.
			P229C2 If cable or obstruction fails to permit full extension rod retraction, terminate the experiment nominally.	
P 2.32	Remove and stow extension rod and extension rod handle.	P232A Extension rod A aft stem section inner rod shears at retaining pin hole.	P232A1 Refer to Contingency Plans P212J1 through P212J3.	
		P232B Extension rod A aft stem section retaining pin shears from inner rod.	P232B1 Refer to Contingency Plans P212I1 through P212I4.	
		P232C Extension rod A end plugs become unbonded.	P232C1 Refer to Contingency Plans P212F1 through P212F4.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 16 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
		P232D Extension rod A outer rod becomes fractured or cracked.	P232D1 Refer to Contingency Plans P212E1 through P212E6.	
		P232E Extension rod A inner rod shears.	P232E1 Refer to Contingency Plans P212C1 through P212C9.	
		P232F Extension rod A forward stem section shears from inner rod.	P232F1 Refer to Contingency Plans P212C1 through P212C9.	
		P232G Mast support tube and extension rod A threads become seized.	P232G1 Rotate the inner rod CCW until firm resistance is sensed, then apply small quantity of O-ring lubricant to forward stem section threads.	Lubricant stowage: E623
			P232G2 Screw extension rod CW until firm resistance is sensed, then reverse the procedure alternately until the rod is released from the mast support tube.	
			P232G3 If the inner rod does not release from the mast support tube, engage the rod LATCH and await further instruction from the ground support personnel.	
			P232G4 If the inner rod does not release from the mast support tube, obtain channel lock pliers from PATK and grip the forward portion of the knurled handle.	
			P232G5 Turn inner rod CCW until it releases from mast support tube.	It may be desirable to resupply the experiment with a backup extension rod handle on the SLM-2 mission.

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 17 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P232G6 Stow extension rod A in the rod stowage rack and attach the extension rod handle to its stowage location on the canister. P232G7 Inspect the mast support tube and extension rod interfaces for galled and stripped threads. P232G8 If damage is extensive (one half of threads are missing or galled) to both components, terminate the experiment nominally.	
		P232H Extension rod handle fails to release from rod A.	P232H1 Refer to Contingency Plan P210A2. P232H2 Restrain the rod/handle assembly, obtain hi torque driver bit No. 1 and spin handle from PATK, remove two screws from rod handle, and retain screws. P232H3 Pull knurled portion of rod handle back away from attached forward section of rod handle. P232H4 Pivot two rod latches open by simultaneously depressing the rear portion of the latch using one 3/16-in. Allen bit and the 3/16-in. blade driver. P232H5 Pull back the forward section of the rod handle while depressing the two rod latches. P232H6 If the handle does not release from the extension rod, obtain 3/32-in. long taper punch and ball peen hammer from PATK.	P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 18 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P232H7 Drive out the 1/8-in. rod turning pin from the handle and retain pin. P232H8 Repeat Contingency Plans P232H4 and P232H5. P232H9 If the handle is released from the extension rod, determine handle component malfunction and reassemble extension rod handle. P232H10 If the handle is deemed inoperable, refer to Contingency Plans P210A3 and P210A4. P232H11 Install the inoperable rod handle on the canister carrying post and secure with pressure sensitive tape. P232H12 If the handle is not released from the extension rod, determine if rod damage has occurred. P232H13 If extension rod A is damaged, proceed to Contingency Plan P232H16. P232H14 Return the operable extension rod to the rod rack and engage the stem section end threads finger tight. P232H15 Stow the operable rod handle on the canister carrying post, and continue experiment preparation.	Tape stowage: E623 and M144. P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 19 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
			P232H16 Return the inoperable extension rod to the rod rack and engage the stem section end threads after reassembling handle on the rod; terminate the experiment nominally.	
P 2.33	Obtain tripod legs and head; assemble unit.	P233A Expando pins cannot be retained in tripod legs.	P233A1 Obtain 3/4-in. pressure sensitive tape and wrap the expanding end of the pins after attaching the pins to the tripod and legs; continue experiment preparation.	Tape stowage: E623 and M144.
P 2.34	Attach tripod to OWS floor at the designated position by turning hand screws.	P234A Hand screws cannot be attached to OWS floor grid (hand screw or nut plate threads stripped).	P234A1 Obtain 3/4-in. pressure sensitive tape and retain near tripod. P234A2 Ensure that the hand screw is attached through the tripod leg, OWS grid floor, and tripod/OWS floor nut plate. P234A3 Wrap several turns of tape about the exposed hand screw threads. P234A4 Attach one 4-in. C-clamp to the tripod leg mounting flange and OWS floor grid, tighten C-clamp, and continue experiment preparation.	
		P234B Hand screws cannot be attached to OWS floor grid (nut plate missing).	P234B1 Refer to Contingency Plan P234A4.	
P 2.37	Attach tripod support bracket to T027 canister assembly (bracket slot towards SAL).	P237A Canister Calfax fasteners will not engage tripod bracket retaining nut plates.	P237A1 Obtain slip joint pliers, cutter pliers, and safety wire from PATK; attach tripod bracket to canister mounting boss.	Safety wire stowage: E623.

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODICAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 20 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
			P237A2 Wrap several turns of safety wire between canister mounting boss flange and tripod bracket flange, twist to tighten, cut off excess wire, and continue experiment preparation.	
P 2.38	Attach photometer system into SAL (refer to SAL experiment installation procedure decal--two crewmen required).	P238A Photometer system interface flange will not attach to the SAL.	P238A1 Remove experiment canister from SAL, inspect canister and SAL mounting flanges for debris, remove debris, and continue experiment preparation. P238A2 Inspect canister and SAL mounting flange seals for damage. P238A3 If seal damage is evident and extensive, terminate the experiment nominally. P238A4 If seal damage is evident but not extensive, continue experiment preparation. P238A5 Inspect the backside of the canister flange plate at each one of the latch dog surfaces to determine indication of SAL latch galling. P238A6 If latch galling is evident at the canister flange, cycle the SAL HANDLE RELEASE to EXPERIMENT LOCK and EXPERIMENT UNLOCK position--three times. P238A7 Determine functional operation of SAL latching dogs. P238A8 Reattach the experiment canister to the SAL and continue experiment preparation.	P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 21 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
P 2.42	Connect SAL INST and SAL PWR cables to photometer common control panel and then to either SAL INST and SAL POWER 1 (+Z SAL) or 2 (-Z SAL) outlet on OWS panels 518/544, using cable restraints.	P242A SAL INST cable cannot connect to panels 518/544 or the common control panel instrumentation receptacles.	P242A1 Substitute experiment S183 SAL INST cable for T027/S073 SAL INST cable.	S183 cable stowage: D424.
			P242A2 Connect to appropriate receptacles and continue experiment preparation.	
			P242A3 If the S183 SAL INST cable is being used, check connector pins on T027/S073 SAL INST cable and straighten if bent.	
			P242A4 Use pin straightener and continue experiment preparation.	Pin straightener stowage: E623.
		P242B SAL PWR cable cannot connect to either panels 518/544 or the control panel power receptacles.	P242B1 Substitute experiment S183 SAL PWR cable for T027/S073 SAL PWR cable.	
			P242B2 Connect to appropriate receptacles and continue experiment preparation.	
			P242B3 If the S183 SAL PWR cable is being used, check the connector pins on T027/S073 SAL PWR cable and straighten if bent.	
			P242B4 Use pin straightener and continue experiment preparation.	Pin straightener stowage: E623.
P 3.8.15	Remove the rod from the rack and mate it to the previously installed rod.	P3815A Extension rod handle fails to attach to rod B or rod C.	P3815A1 Refer to Contingency Plans P210A1 through P210A4.	
		P3815B Extension rod B or rod C forward stem threads are stripped.	P3815B1 Notify the ground support personnel of extension rod damage and secure from experiment photometer deployment.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 22 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P3815B2 Retract the photometer into the canister, engage the rod LATCH into the mast support tube slot, and stow the rod and handle.	
			P3815B3 Close the SAL doors and await further uplink instructions.	
		P3815C Extension rod B or rod C index pins are bent out of alignment.	P3815C1 Refer to Contingency Plans P212A1 and P212A2.	
		P3815D Extension rod B or rod C index pins are lost.	P3815D1 Refer to Contingency Plan P212B1.	
		P3815E Extension rod B or rod C forward stem section shears from inner rod.	P3815E1 Notify the ground support personnel of extension rod failure and secure from experiment photometer deployment.	
			P3815E2 Refer to Contingency Plans P212C1 through P212C3.	
			P3815E3 Unscrew the stem section CCW, and dispose of it in the trash container or bag.	Trash container stowage: F568.
			P3815E4 Release extension rod handle from stowage, disconnect and stow remaining B rods.	
			P3815E5 Retract extension rod A, engage the rod LATCH into mast support tube slot, and stow the rod and handle.	
			P3815E6 Close the SAL doors, refer to Contingency Plans P212C7 through P212C9, and await further uplink instructions.	P

ASTN-OT-7 (Feb. 72)

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 23 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions,corrections,results)
		P3815F Extension rod B inner rod shears.	P3815F1 Refer to Contingency Plans P3815E1 through P3815E6.	
		P3815G Extension rod C inner rod shears.	P3815G1 Continue to deploy photometer (refer to Operation Step Nos. P 3.14 through P 3.18) if the rod A/B and rod C interface connection is secure.	The UXM cannot be made rigid (preloaded) for photometer head orientation operations (scans).
			P3815G2 Verify that the rod LATCH engages extension rod C slot.	
			P3815G3 Do not turn crank handle.	
			P3815G4 Terminate experiment deployment and await further uplink instructions.	Refer to Contingency Plan P212C9, Remarks (tube cutter). Be prepared to eject photometer and UXM (refer to Contingency Plan T26B1).
		P3815H Extension rod B or rod C outer rod becomes fractured or cracked.	P3815H1 Refer to Contingency Plans P212E1 through P212E6.	
		P3815I Extension rod B end plugs become unbonded.	P3815I1 Remove all B extension rods and stow in rod rack.	
			P3815I2 Refer to Contingency Plans P212F1 through P212F4.	
		P3815J Extension rod C forward end plug or rod segment splice becomes unbonded.	P3815J1 Remove the C rod from either B rod or A rod.	
			P3815J2 Remove all B extension rods and stow in rod rack.	
			P3815J3 Refer to Contingency Plans P212F1 through P212F4.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 24 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
		P3815K Extension rod B or rod C outer tube is severly dented.	P3815K1 Refer to Contingency Plans P212G1 through P212G4.	
		P3815L Extension rod B or rod C tube rod gouged.	P3815L1 Refer to Contingency Plan P212H1.	
		P3815M Extension rod B aft stem section retaining pin shears from inner rod.	P3815M1 Remove extension rod handle and stow on canister assembly.	
			P3815M2 Determine the nature and extent of stem section damage. If the tip of the inner rod is lost, refer to Contingency Plans P3815O1 through P3815O6.	
			P3815M3 Disconnect the extension rod from the previously assembled rod using Contingency Plans P212I3 through P212I5, and return the rod to the rod rack.	
			P3815M4 Terminate experiment deployment, await further uplink instructions, or implement Contingency Plans P3815M5 through P3815M11.	
			P3815M5 Assemble other extension rods (B).	If more than one B rod fails, terminate the experiment using the appropriate contingency plans.
			P3815M6 Reconnect the malfunctioned B rod (sixth extension rod) using channel lock pliers.	
			P3815M7 Remove channel lock pliers, tape from Allen bit, Allen bit, and stem section (retain stem section) from the extension rod.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 25 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P3815M8 Do not release the tube brake to deploy the extension rod.	
			P3815M9 Release the rod LATCH.	
			P3815M10 Assemble extension rod C to rod B and deploy both extension rods until the rod LATCH engages into the C rod slot.	
			P3815M11 Continue experiment deployment.	
		P3815N Extension rod C aft stem section retaining pin shears from inner rod.	P3815N1 Remove extension rod handle and stow on canister assembly.	Dispose of rod stem section end and washer in trash container F568.
			P3815N2 Inspect the interface connection between extension rod C and the previously installed rod. Ensure that no gap exists between the extension rods.	
			P3815N3 If a gap is visible between the C extension rod and the previously installed rod, obtain channel lock pliers from PATK, grip the end of the inner rod and turn CW until resistance loading is sensed (the gap between the rods should be eliminated).	
			P3815N4 Remove channel lock pliers from inner rod stem end and continue experiment deployment.	
		P3815O Extension rod B aft stem section inner rod shears at retaining pin hole.	P3815O1 Remove extension rod handle and stow on canister assembly.	

P

TABLE T-IV. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT PREPARATION (P) (Sheet 26 of 26)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
			P3815O2 Determine the nature and extent of stem section damage. If only the pin is sheared from the inner rod, refer to Contingency Plans P3815M3 through P3815M11. If the tip of the inner rod is lost, refer to Contingency Plans P212C1 and P212C3.	
			P3815O3 Unscrew the inner rod/stem section CCW from the previously installed extension rod, and dispose of inner rod in trash container.	Trash container location: F568.
			P3815O4 Continue experiment deployment until extension rod C is LATCHED and secured.	
			P3815O5 Refer to Contingency Plans P212C7 and P212C8.	
			P3815O6 Wrap several turns of tape about the outer rod section adjacent to the backside of the mechanical control panel rod rack; continue experiment deployment.	Refer to Contingency Plan P212C9, Remarks.
		P3815P Extension rod C aft stem section inner rod shears at retaining pin hole.	P3815P1 Refer to Contingency Plans P310N1 through P310N4.	
P 3.8.2.12	Preload the UXM.	P38212A The UXM cannot be preloaded.	P38212A1 Continue experiment deployment and await further uplink instructions.	It is noticed that the crank handle is rotated CW a significant number of turns beyond 37. This indication means that the external screw assembly has become unbonded from the inner threaded rod assembly. P

ASTN-OT-7 (Feb. 72)

TABLE T-V. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT OPERATION (O)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
		TBS		

O

TABLE T-VI. EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN / ZODIACAL LIGHT MALFUNCTION AND CONTINGENCY PLAN OUTLINE - EXPERIMENT TERMINATION (T)

Operation Step Number	Experiment/Crew Tasks	Possible Malfunction	Contingency Plan	Remarks (malfunctions, corrections, results)
		TBS		

ASTN-OT-9 (Feb. 72)

T

SECTION IX.

EXPERIMENT T-027/S-073, CONTAMINATION MEASUREMENT, PHOTOMETER AND GEGENSCHEIN/ZODIACAL LIGHT MALFUNCTION ANALYSES

(1)

2. CONTAMINATION MEASUREMENT, T027

The T027 experiment consists of two separate hardware systems, each retrieving different and independent data. One system is the Sample Array, and the other system is the Photometer.

The primary Sample Array and Photometer operational functions requiring analysis are presented in Table 2.1. Figure 2.1 thru 2.5 depict the relationships used to develop this table and also presents those items analyzed in this issue of the document. (1)

Table 2.1 Operational Functions and Malfunction Analysis Items, T027

Operational Function	Sub-Function	Malfunction Analysis Item
2.1 Provide Sample Array		

(1)

Table 2.1 Operational Functions and Malfunction Analysis Items, T027 (Continued)

Operational Function	Sub-Function	Malfunction Analysis Item
2.2 Provide Photometer System	2.2.1 Provide Electronics	2.2.1.1 PMT failure 2.2.1.2 PMT Shutter Control Failure 2.2.1.3 PMT Cap Control Failure 2.2.1.4 FOV Control Failure 2.2.1.5 Filter Wheel Control Failure 2.2.1.6 Polarizer Wheel Control Failure 2.2.1.7 Trunnion Control Failure 2.2.1.8 Shaft Control Failure 2.2.1.9 Camera Control Failure
	2.2.2 Provide Power and Timing	2.2.2.1 Input Power Failure 2.2.2.2 Failure to Provide Logic Power/Timing 2.2.2.3 Fails to Supply 115 Volts, 400 Hz Power 2.2.2.4 Fails to Supply 27 Volts, 400 Hz Power 2.2.2.5 Fails to Supply Camera Power 2.2.2.6 Fails to Supply OP AMP Power 2.2.2.7 Fails to Supply Solenoid Power 2.2.2.8 Fails to Supply Stepper Motor Power

(1)

Table 2.1 Operational Functions and Malfunction Analysis Items, T027 (Continued)

Operational Function	Sub-Function	Malfunction Analysis Item
	2.2.3 Provide Mechanical Functions	2.2.3.1 Stowage Container Fasteners Fail Open/Closed 2.2.3.2 Calfax Fasteners Failure 2.2.3.3 Front End Plate Failure 2.2.3.4 UXM Handle Failure 2.2.3.5 UXM Rod A Failure 2.2.3.6 UXM Rod B or C Failure 2.2.3.7 UXM Latch Failure 2.2.3.8 UXM Mast Failure 2.2.3.9 Shaft or Trunnion Lock Failure 2.2.3.10 Head Mounting Failure 2.2.3.11 UXM Crank Failure 2.2.3.12 Camera Magazine Failure
	2.2.4 Provide Optics	2.2.4.1 Lens Contamination

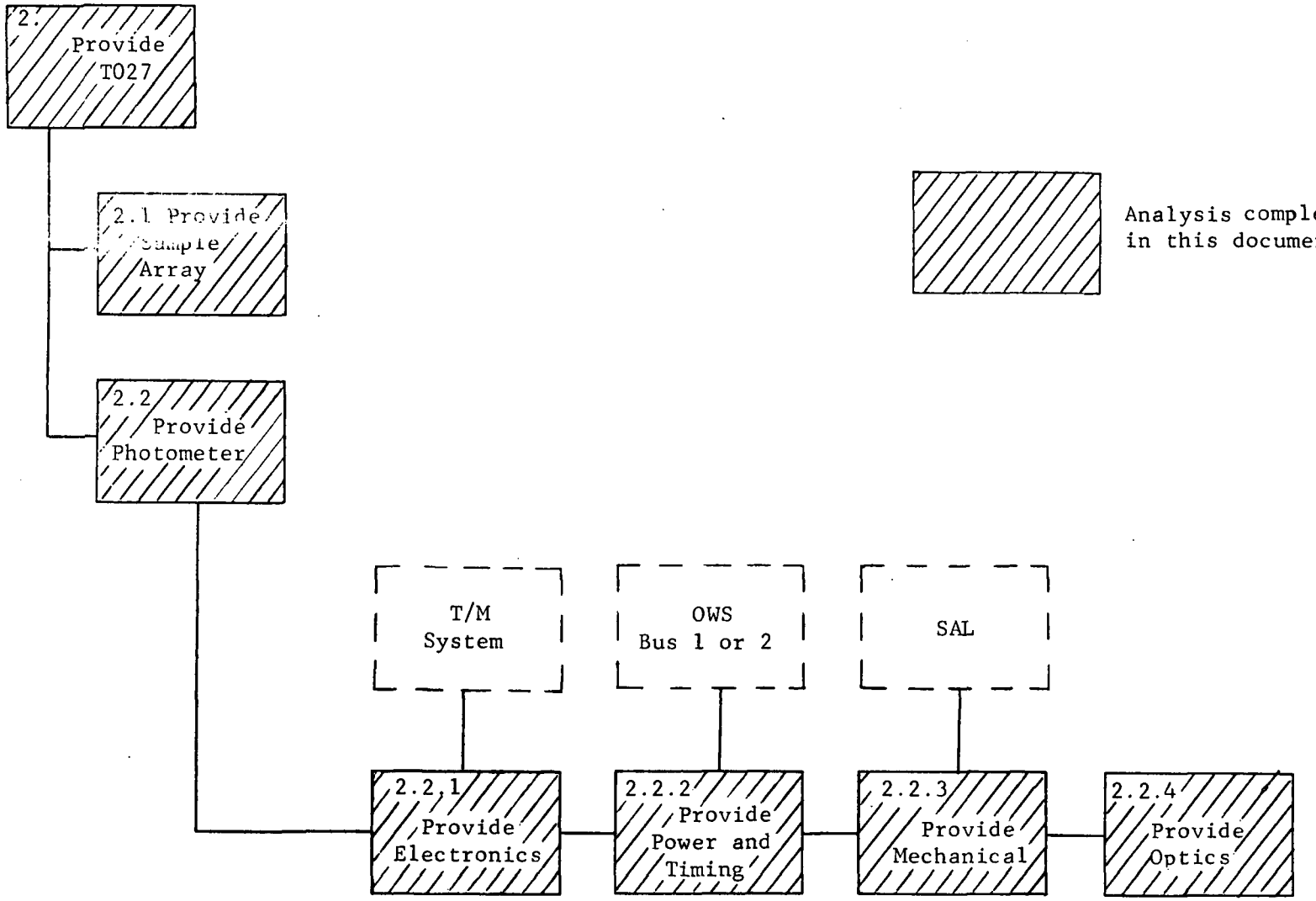


Figure 2.2 Functional Flow Diagram, T027 Photometer

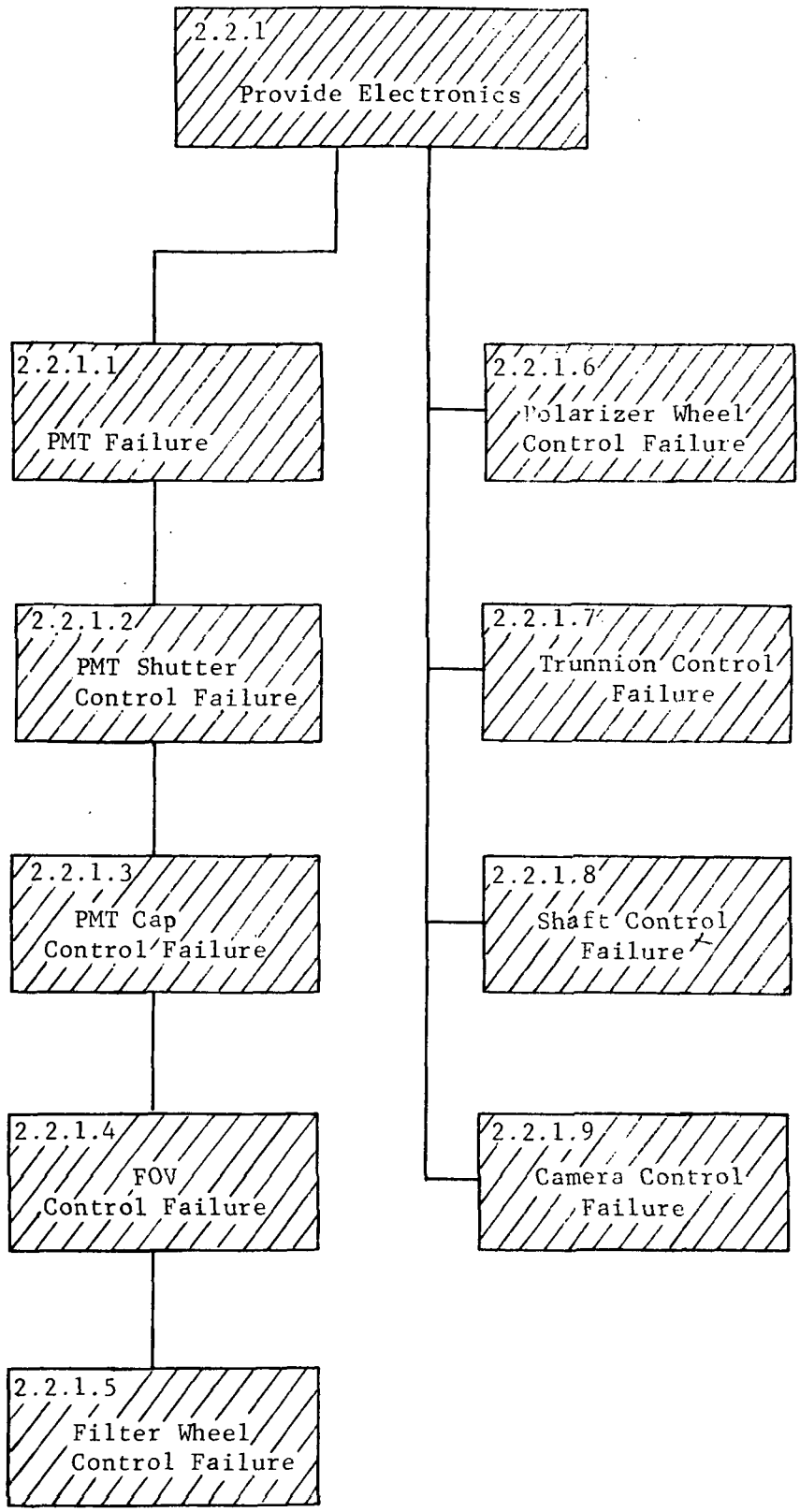


Figure 2.3 Malfunction Analysis Diagram,
T027 Photometer Electronics

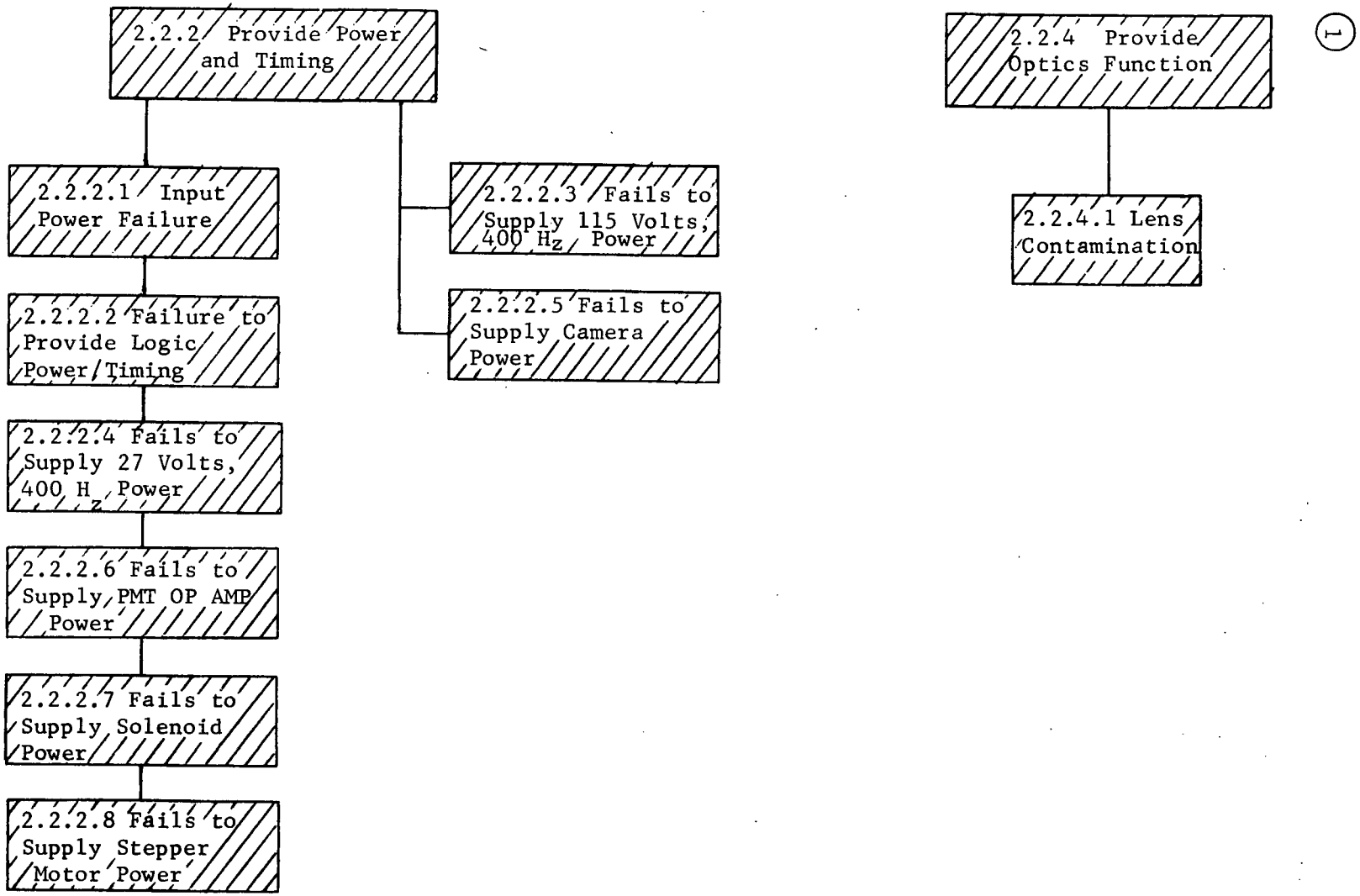


Figure 2.4 Malfunction Analysis Diagram

T027 Photometer Power and Timing, and Optics Functions

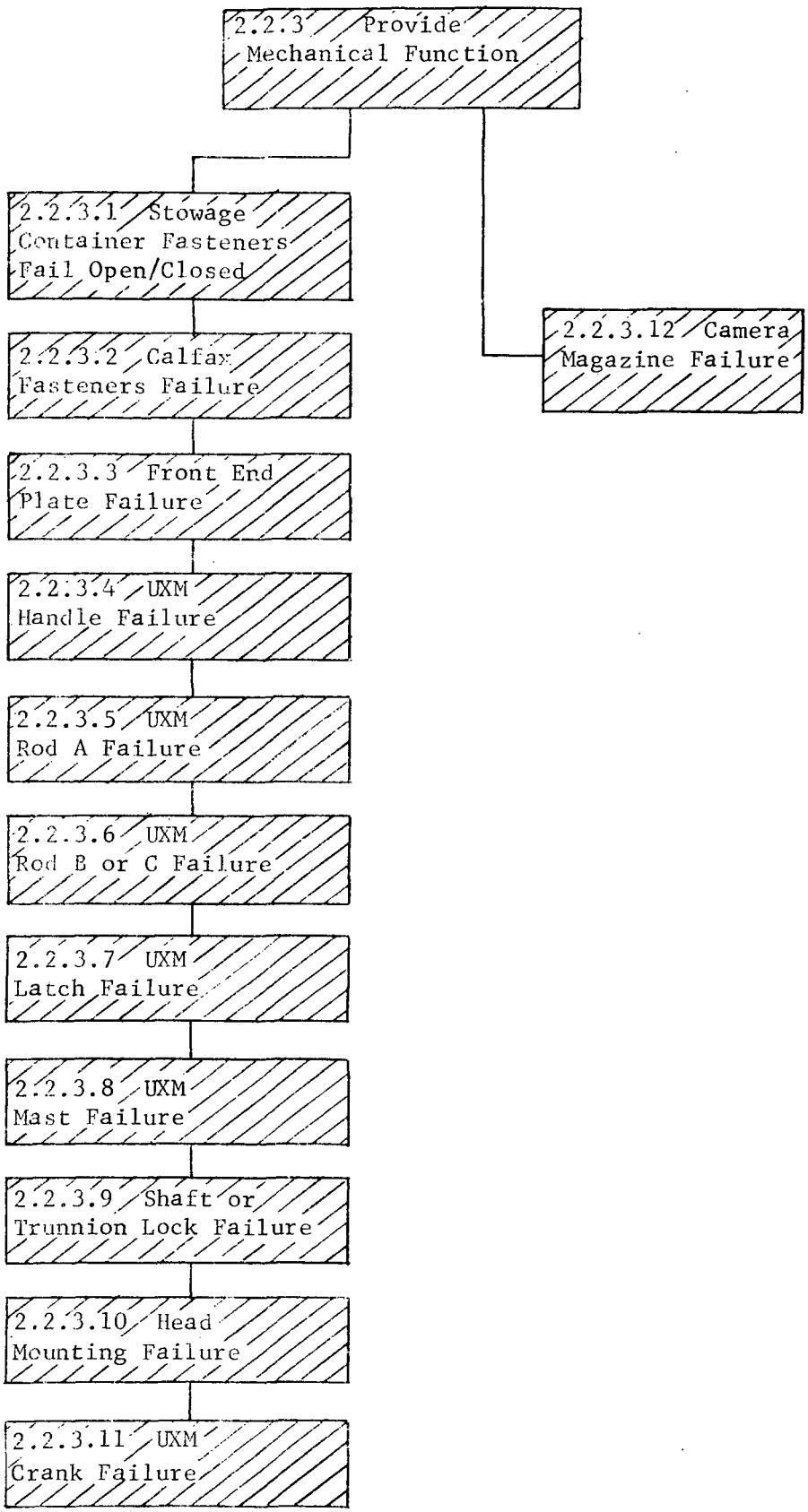


Figure 2.5 Malfunction Analysis Diagram,
T027 Photometer Mechanical Function

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2 Provide Photometer System 2.2.1 Provide Electronics 2.2.1.1 PMT Failure						Ground Action: Phases D, F, and H Crew Action: Phases D, F, and H
a. PMT Output Failure (PMT Package, Amp on T/M Bd)	M7072S073/M7074T027-PMT Current (U): $\leq .01$ or $\geq .99$ μamps in conjunction with K7277S073/K7265T027-PMT Shutter Bit State 0 (open).	INTENSITY ind (U): Does not change in reading when changing FOV or FW and shutter open.	Mission: None Crew: Timeline effect.	Loss of Photometer System.	Same as system effect for S073.	1. Recycle or change GAIN sw position, or 2. Recycle PMT SHUTTER sw, and 3. Terminate Photometer portion and take 16 mm camera data only.
b. Voltmeter Failure (Amp on Unique Bd, Voltmeter)	M7072S073/M7074T027-PMT Current (U): .01 thru .99 μamps in conjunction with INTENSITY ind reads 0 or does not change in reading when changing FOV or FW.	None	Mission: None Crew: Timeline effect.	Loss of information on PMT output for proper FOV sw and GAIN sw operation.	Same as system effect for S073.	1. Tap on INTENSITY ind face, or 2. Keep close contact with ground as to the quality of PMT output data and needed gain and/or FOV changes. (1)
c. Gain Control Failure (GAIN sw Short/Open, Gain Relays, PMT Package)	M7072S073/M7074T027-PMT Current (U): PMT current does not change in conjunction with K7279S073/K7267T027-Med PMT Gain or K7278S073/K7266T027-High PMT Gain Bit State change	INTENSITY ind (U): Does not change reading in conjunction with operating GAIN sw but does change reading in conjunction with a FOV or FW change.	Mission: None Crew: Timeline effect.	Loss of gain control on PMT for keeping output current within scale.	Same as system effect for S073.	1. Recycle GAIN sw, and 2. Use different FOV settings to keep INTENSITY ind on scale (use higher FOV setting for off scale high position).

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.2 PMT Shutter Control Failure						
a. Fails to Open	K7277S073/K7265T027-PMT Shutter (U): Bit state 1 (closed)	M7072S073/M7074T027 PMT Current (U): < .01 μamps or PMT SHT lt (U): On	Mission: None Crew: Timeline effect.	Loss of shutter control, no light gets to PMT and Photometer System is lost.	Same as system effect for S073.	
	In conjunction with shutter commanded open.					
Case I. Programmer Control (PROGRAM sw Open/Short, Programmer, OR Gate, Flip Flop Control Ckt on Relay Driver Bd Including Relays, Shutter Solenoid)						1. Recycle PROGRAM sw, and 2. a. Recycle POWER sw when FW and FOV not moving, i.e. does not change positions for 20 sec, and b. Use different programmer modes, and 3. a. Remove cable from J10 on Manual Control Panel and replace with shorting plug P10A, and b. Operate Photometer System manually, or 4. Terminate Photometer portion of experiment, take 16 mm camera data only.
Case II. Manual Control (PMT SHUTTER sw Short/Open, Flip Flop Ckt, OR Gate, PMT Shutter Control Ckt on FW Bd, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Shutter Solenoid).						1. Recycle PMT SHUTTER sw, and 2. Return to programmer control nominally, and 3. Use filter wheel program control nominally, or 4. Terminate Photometer portion of experiment, take 16 mm camera data only.

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.2 PMT Shutter Control Failure (Continued) a. Fails to Open (Continued) Case III. FW Program Control (FW Bd Gates, PROGRAM sw Open/Short, OR Gate, PMT Shutter Control Ckt on FW Bd, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Shutter Solenoid).						1. Recycle PROGRAM sw, and 2. Return to programmer control nominally, and 3. Push PMT SHUTTER sw to OPEN, or 4. Terminate photometer portion of experiment, take 16 mm camera data only.
Case IV. Mechanical Failure (Shutter Closed, FW Between Filters).						1. a. Remove from SAL nominally, and (1) b. Extend one rod length, and c. Utilizing ball peen hammer, (Ref 6) tap on photometer head, or d. Utilizing hammer (step c) strike photometer head with medium force, or 2. a. Disassemble photometer head, and b. Manually manipulate components, and c. Reassemble photometer head, and d. Apply power to verify operation, or 3. Apply power and strike with hammer (step c), or 4. Same as step 4, Case III, 2.2.1.2a.

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.2 PMT Shutter Control Failure (Continued)						
b. Fails to Close	K7277S073/K7265T027-PMT Shutter (U): Bit state 0 (open) In conjunction with shutter commanded closed.	M7072S073/M7074T027-PMT Current (U): $\geq$ .01 μamps or PMT SHT lt (U): OFF	Mission: None Crew: Timeline effect.	Loss of shutter control, possible to get too much light to PMT and burn it out.	Same as system effect for S073.	
Case I. Programmer Control (Programmer, Input on OR Gate)						1. Push PMT SHUTTER sw to close, and (1) 2. Same as step 2, Case I, 2.2.1.2a, and 3. Use filter wheel control nominally. Note: This will operate the system and sequence FW-A through all 5 filters before closing shutter.
Case II. Manual Control (PMT SHUTTER sw Open in CLOSE Position, Input on OR Gate)						1. Recycle PMT SHUTTER sw, and 2. Same as step 3, Case I, 2.2.1.2b, and 3. Use programmer control nominally.

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.2 PMT Shutter Control Failure (Continued) b. Fails to Close (Continued) Case III. FW Program Control (FW Bd Gates, Input on OR Gate)						1. Push PMT SHUTTER sw to CLOSE, and 2. Use programmer control nominally.
Case IV. All of the Above Cases (Output on OR Gate, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Shutter Solenoid, Mechanical Hang-up)						1. Same as steps 1, and 3, Case I and step 3, Case II, 2.2.1.2b, or 2. Continue operating Photometer System manually with extreme care not to point at bright objects. Note: Close cap when not taking data or PMT overvoltage i.e., INTENSITY ind full scale.
2.2.1.3 PMT Cap Control Failure a. Fails to Open	K7276S073/K7264T027-PMT Cap (U): Bit state 1 (closed) in conjunction with cap commanded open.	M7072S073/M7074T027-PMT Current (U): No change when shaft or trunnion is moved but does change with changes in optic path. PMT CAP lt (U): ON in conjunction with cap commanded open INTENSITY ind (U): Does not change when shaft or trunnion is moved but does change in conjunction with different FOV or FW settings.	Mission: None Crew: Timeline effect.	Loss of cap control, no outside light gets to PMT and Photometer System is lost.	Same as system effect for S073.	

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.3 PMT Cap Control Failure (Continued) a. Fails to Open (Continued) Case I. Programmer Control (Programmer, OR Gate, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Cap Solenoid)						1. a. Recycle POWER sw when FW and FOV not moving, i.e. does not change positions for 20 sec, and b. Use different programmer modes, and 2. Push PMT CAP sw to OPEN, and 3. a. Put shorting plug P10A on J10 Manual Control Panel, and b. Put FILTER WHEEL AUTO sw in pos FW-A, and c. Operate PROGRAM sw, or 4. Terminate photometer portion of experiment nominally, take 16 mm data only.
Case II. Manual Control (PMT CAP sw Short/Open, OR Gate, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Cap Solenoid)						1. Recycle PMT CAP sw, and 2. Return to programmer control nominally, and 3. Use filter wheel program control nominally, or 4. Terminate photometer portion of experiment, take 16 mm camera data only.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.3 PMT Cap Control Failure (Continued) a. Fails to Open (Continued) Case III. FW Program Control (OR Gate, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Cap Solenoid)						1. Push PMT CAP sw to OPEN, then release, and 2. Return to programmer control nominally, or 3. Terminate photometer portion of experiment, take 16 mm data only.
Case IV. Mechanical Hang-up						1. Same as steps 1, 2, and 3, Case IV, 2.2.1.2a, or (1) 2. Terminate photometer portion of experiment nominally. Take 16 mm data only.
b. Fails to Close	K7276S073/K7264T027-PMT Cap (U): Bit state 0 (open) in conjunction with cap commanded closed.	M707?S073/M7074T027-PMT Current (U): Changes in conjunction with shaft or trunnion moving and shutter is open. PMT CAP lt (U): OFF when cap should be closed INTENSITY ind (U): Changes in conjunction with shaft or trunnion moving and shutter is open.	Mission: None Crew: Timeline effect.	Loss of cap control, calibration source can not be used, therefore degraded data because of no PMT calibration.	Same as system effect for S073.	

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS-CHART, T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.3 PMT Cap Control Failure (Continued) b. Fails to Close (Continued) Case I. Programmer Control (Programmer, Input on OR Gate)						1. Push PMT CAP sw to CLOSE, and 2. Same as step 2, Case I, 2.2.1.2a, and 3. Use filter wheel control nominally. Note: This will operate the system and sequence FW-A through all 5 filters before closing cap.
Case II. Manual Control (PMT CAP sw, Open in CLOSE Position, Input on OR Gate)						1. Recycle PMT CAP sw, and 2. Use programmer control nominally, and 3. Same as step 3, Case I, 2.2.1.3b.
Case III. FW. Program Control (FW Bd Gates, PROGRAM START sw, Input on OR Gate)						1. Push PMT CAP sw to CLOSE, and 2. Use programmer control nominally.
Case IV. All of the Above Cases (Output on OR Gate, Flip Flop, Control Ckt on Relay Driver Bd Including Relays, Cap Solenoid, Mechanical Hang-up)						1. Same as steps 2 and 3, Case III and step 3 Case I, 2.2.1.3b, or 2. Continue nominal operation with the exclusion of calibration.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.4 FOV Control Failure						
a. Fails to Advance (FOV sw Short, FOV Control Ckts on Camera-FOV Bd, Sequential Pulse Generator for Stepper Motor, Drivers, FOV Motor, Mechanical Hang-up).	K7288S073/K7275T027-FOV Wheel 2° (U): No bit change In conjunction with FOV being stepped.	M7072S073/M7074T027-PMT Current (U): Does not change FOV ind (U): Does not change INTENSITY ind (U): Does not change	Mission: None Crew: Timeline effect.	Loss of FOV control. Depending on position stuck in, too much or too little light may reach the PMT causing some loss of data.	Same as system effect for S073.	1. Recycle FOV sw, and 2. Use appropriate GAIN sw settings to keep INTENSITY ind on scale, and 3. Keep pointing control in sky areas with proper light intensity and operate in degraded mode.
b. Continuous Advancing (FOV sw Open, Flip Flop Stuck in Set Position).	K7288S073/K7275T027-FOV Wheel 2° (U): Bit change every 4 sec.	FOV ind (U): Changes reading every 4 sec.	Mission: None Crew: Timeline effect.	FOV wheel keeps turning causing loss of most/all PMT data.	Same as system effect for S073.	1. When FW not moving, i.e. does not change positions for 20 sec, recycle POWER sw immediately following a FOV ind change, and 2. Take fixed pointing data, and 3. Terminate photometer portion of experiment, take 16 mm camera data only.
c. Fails to Indicate Position			Mission: None Crew: Timeline effect.	Loss of FOV position information for proper FOV control.	Same as system effect for S073.	
Case I. Onboard Only (Readout Control Ckt, FOV ind).	FOV ind (U): Not illuminated. (U): Does not change reading when FOV wheel stepped in conjunction with INTENSITY ind changes reading.	None				1. Keep close track of last position FOV left in, and 2. Check with ground to verify position.

MISSION PHASES: A. All Phases; B. Boost to Orbit; C. Activation; D. 1st Visitation; E. 1st Storage; F. 2nd Visitation; G. 2nd Storage; H. 3rd Visitation

(1) 2-21

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.4 FOV Control Failure (Continued) c. Fails to Indicate Position (Continued) Case II. Onboard and T/M (0-5 Position Counter, Micro sw, Micro sw Ckt)	FOV ind (U): Does not change reading when FOV wheel stepped in conjunction with INTENSITY ind changing reading. (U): Does not track with FOV wheel, i.e FOV ind goes to higher number and INTENSITY ind reads higher.	None				1. Keep close track of last position left in. (FOV in position 0 when INTENSITY ind has much higher indication in new FOV setting.)
2.2.1.5 Filter Wheel Control Failure a. Fails to Advance FW-A	K7282S073/K7270T027-Filter Wheel A2° (U): No bit change when FW-A is stepped.	M7072S073/M7074T027-PMT Current (U): Does not change in conjunction with FW A being stepped and K72775073/K7265T027 PMT Shutter bit state 0 (open). FW-A ind (U): Does not change when F.W. A is stepped. INTENSITY ind (U): Same as PMT current above.	Mission: None Crew: Timeline effect.	Loss of FW-A control. If failed in 0 position then 5 filters usable on wheel B. If failed in position 1-5 then that is only filter available (restricts data to filter(s) available)	Same as system effect for S073.	

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART (U2)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.5 Filter Wheel Control Failure (Continued) a. Fails to Advance FW-A (Continued) Case I. Programmer Control (Programmer, Auto A Flip Flop, All Common F.W. A Ckts)						1. a. Recycle POWER sw when FW and FOV not moving, i.e. does not change positions for 20 sec, and b. Use different programmer modes, and 2. Push FILTER WHEEL STEP sw to MAN A, and 3. Use FW sequencing nominally, and 4. a. If in position 0, use FW-B nominally, and b. If in position other than 0 keep FW-B in position 0 and continue experiment, and c. If between positions remove from SAL, take apart head and manually move FW-A to position 0.
Case II. Manual Control (FILTER WHEEL STEP sw Open/Short, Man A Flip Flop, All Common FW-A Ckts)						1. Recycle FILTER WHEEL step sw, and 2. Use FW sequencing nominally, and 3. Use programmer control nominally. 4. Same as step 4, Case I, 2.2.1.5a.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.5 Filter Wheel Control Failure (Continued) a. Fails to Advance FW-A (Continued) Case III. Auto Sequencing (FILTER WHEEL AUTO sw Shorted in Position B, PROGRAM sw Short/Open, Auto Sequencing Ckt, all Common FW-A Ckts)						1. a. Recycle FILTER WHEEL AUTO sw, and b. Recycle PROGRAM sw, and 2. Push FILTER WHEEL STEP sw to MAN A, and 3. Use programmer control nominally, and 4. Same as step 4, Case I, 2.2.1.5a. (1)
b. FW-A Does Not Stop Advancing (A ON Flip Flop Stuck in Set State)	K7282S073/K7270I027-Filter Wheel 2° (U): Bit change every 4 sec	K7277S073/K7265T027-PMT Shutter (U): Bit state 1 (closed) (This is not conclusive by itself) FW-A ind (U): Changes every 4 sec PMT SHUTTER lt (U): ON (This is not conclusive by itself)	Mission: None Crew: Timeline effect.	Loss of Photometer System.	Same as system effect for S073.	1. Recycle POWER sw immediately following a FW-A ind change. 2. Terminate photometer portion of experiment, take 16 mm camera data only.
c. Fails to Advance FW-B Same Cases and Causes as 2.2.1.5a, (Substitute B for A)	K7285S073/K7268T027-Filter wheel B2° (U): No bit change when FW-B is stepped.	Same as 2.2.1.5a (substitute for FW-A).	Mission: None Crew: Timeline effect.	Same as 2.2.1.5a (substitute B for A and A for B)	Same as system effect for S073.	Same as 2.2.1.5a (substitute B for A and A for B).

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.5 Filter Wheel Control Failure (Continued)						
d. FW-B Does Not Stop Advancing (B ON Flip Flop Stuck in Set Position)	K7285S073/K7268T027-Filter Wheel B2° (U): Bit change every 4 sec.	Same as 2.2.1.5b (substitute FW-B for FW-A).	Mission: None Crew: Timeline effect.	Loss of Photometer System.	Same as system effect for S073.	Same as 2.2.1.5b (substitute FW-B for FW-A).
e. FW-A/B Fails to Indicate Position			Mission: None Crew: Timeline effect.	Loss of FW position information for proper FW control.	Same as system effect for S073.	
Case I. Onboard Only (Readout Control Ckt, FW ind).	FW ind (U): Not illuminated. (U): Does not change reading when FW stepped in conjunction with INTENSITY ind changes reading.	None				1. Keep close track of last position FW-A/B left in, and 2. Check with ground to verify position.
Case II. Onboard and T/M (0-5 Position counter, Micro sw, Micro sw Ckt)	FW ind (U): Does not change reading when FW stepped in conjunction with INTENSITY ind changes reading. (U): Does not track with FW, i.e. INTENSITY ind reads much higher (pos 0) and FW-A/B indicates 1-5.	None				1. Keep close track of last position FW-A/B left in. (FW-A and B position 0 when INTENSITY ind has much higher indication on new FW setting.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.6 Polarizer Wheel Control Failure (EXPERIMENT SELECT sw Shorted in S149 Position, Programmer (When Connected), and Gate, Relay Driver and Relays, Polarizer Motor)	K7171S073/K7170T027-Polarizer Wheel Sync (U): No bit change	M7072S073/M7074T027 PMT Current (U): Output level vs time is constant over any .5 sec period, (with polarizer wheel turning, output will vary with a 2 CPS rep rate) in conjunction with K7277S073/K7265T027 PMT Shutter bit state 0 (open) and K7276S073/ K7264T027-PMT Cap bit state 0 (open)	Mission: None Crew: Timeline effect	No polarization information of the data is obtained.	Same as system effect for S073.	1. Recycle EXPERIMENT SELECT sw, or 2. Put shorting plug P10A on J10 of Manual Control Panel and operate experiment manually, or 3. a. Put S149 sw in OPEN position and b. Put EXPERIMENT SELECT sw in S149 position, and c. Operate experiment manually, and d. Put EXPERIMENT SELECT sw in T027/S073 position before moving shaft or trunnion, return to S149 position after moving shaft/ trunnion to take data, and 4. Operate photometer system without the polarization.
2.2.1.7 Trunnion Control Failure		TRUNNION ind (U): Does not change when trunnion should be moving (common sensor with primary cue).				
a. Fails to Move (Either or Both Directions)	G7053S073/G7016T027 Trunnion Position (U): No bit change when trunnion should be moving.	M7072S073/M7074T027-PMT Current (U): Does not change in reading when trunnion should be moving and cap and shutter are open. (Inconclusive indication of this failure)	Mission: None Crew: Timeline effect.	Incomplete data. Also, if failed in any position other than TRUNNION ind 000 the boom cannot be retracted into the SAL, and must be ejected	Loss of data and UXM. UXM cannot be used for S073, S149 or ECTV.	

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.7 Trunnion Control Failure (Continued) a. Fails to Move (Either or Both Directions) (Continued)		INTENSITY ind (U): Does not change in reading when trunnion should be moving. (Inconclusive indication of this failure.)				
Case I. Programmer Control (Programmer, Auto Control Ckt, Encoder, EXPERIMENT SELECT sw Shorted in S149 Position, Relay K3, Trunnion Motor Control Ckt, Drivers, Relays, Trunnion Motor)						1. Recycle EXPERIMENT SELECT sw, and 2. Recycle POWER sw when FW and FOV not moving, i.e. does not change positions for 20 sec, and 3. Place shorting plug P10A on J10 of Manual Control Panel and place TRUNNION sw in INCR/DECR position, and 4. a. Take all possible data within limits of operation, and b. End experiment nominally if TRUNNION ind 000, and c. Eject nominally after taking all possible data if TRUNNION ind not 000.
Case II Manual Control (TRUNNION sw Open/Short, Manual Control Ckt, EXPERIMENT SELECT sw Shorted in S149 Position, Relay K3, Trunnion Motor Control Ckt, Drivers, Relays, Trunnion Motor)						1. Recycle EXPERIMENT SELECT sw, and 2. Recycle TRUNNION sw, and 3. Use programmer control nominally, or 4. Same as step 4, Case I, 2.2.1.7a.

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027 (1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.7 Trunnion Control Failure (Continued)						
b. Fails to Indicate Position (Encoder, Amps, 7 Bar Ckt, TRUNNION ind)			Mission: None Crew: Timeline effect.	Loss of proper control of trunnion and pointing information.	Same as system effect for S073	
Case I. Static or No Reading	TRUNNION ind (U): Does not read (U): Does not change reading when trunnion moves (INTENSITY ind changes reading)	None				1. Use programmer control, and 2. Trunnion moves at 4 deg/sec. Use this to calculate time motor should be on to move desired number of degrees. Check with ground for results.
Case II. Incompatible Readout	TRUNNION ind (U): Does not track with trunnion (mechanical end stops do not read 000 and 120)	None				1. a. Take all possible data within limits of operation, and b. Eject nominally after taking all possible data. (1)
2.2.1.8 Shaft Control Failure						
a. Fails to Move (Either or Both Directions) Note: Same cases and causes as 2.2.1.7a, (substitute shaft for trunnion).	G7015S073/G7025T027 Shaft Position (U): Same as 2.2.1.7a (substitute shaft for trunnion).	Same as 2.2.1.7a (substitute shaft for trunnion)	Mission: None Crew: Timeline effect.	Incomplete data. Also, if failed in any position other than SHAFT ind 040 the boom cannot be retracted into the SAL, and must be ejected.	Same as 2.2.1.7a.	Same as 2.2.1.7a substitute shaft for trunnion, and 040 for 000 (the position for retracting the UXM).

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027 (1)

MALFUNCTION		INDICATION		EFFECT			ACTION
	MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.8 Shaft Control Failure (Continued)							
b. Fails to Indicate Position Same Cases and Causes as 2.2.1.7b (Substitute Shaft for Trunnion)		Same as 2.2.1.7b (substitute shaft for trunnion, and 000, 374 for 000, 120 as the end stops).	None	Mission: None Crew: Timeline effect.	Loss of proper control of shaft, and pointing information.	Same as system effect for S073.	Same as 2.2.1.7b (substitute shaft for trunnion).
2.2.1.9 Camera Control Failure		K7308S073/K7309T027-Camera Exposure, inconclusive, sample rate too low.	CAMERA SHT lt (U): ON when camera should be operating; or OFF when camera should not be running.	Mission: None Crew: Minimum timeline effect.	Loss of 16 mm camera information.	Same effect for S073 as system effect.	
	Case I. Programmer Control (Programmer, Input on OR Gate)						1. Put SEQ sw to START, and 2. Operate CAMERA SHUTTER sw nominally to open and close shutter, and 3. Operate photometer experiment nominally, discontinue 16 mm camera operation.
	Case II. Manual Control (CAMERA SHUTTER sw Short/Open, "Man" Flip Flop, Input on OR Gate).						1. Recycle CAMERA SHUTTER sw, and 2. If camera shutter closed, operate SEQ sw nominally, or 3. a. If camera shutter open, operate SEQ sw when FOV and FW not moving, and b. Turn POWER sw to OFF when shutter closes (CAMERA SHT lt on), wait 15 sec, and c. Turn POWER sw to ON, and d. Recycle SEQ sw to operate camera, and

(1)

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART T027

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.1.9 Camera Control Failure (Continued) Case II. Manual Control (CAMERA SHUTTER sw Short/Open, "Man" Flip Flop, Input on OR Gate). (Continued)						4. Use programmer control of experiment nominally, or 5. Operate photometer experiment nominally, discontinue 16 mm camera operation.
Case III. Auto Sequence (SEQ START sw, F.W. Program Start Ckt, "Seq" OR Gate, Auto Sequencer Ckt, Input on OR Gate)						1. Recycle SEQ sw, and 2. Operate camera manually via CAMERA SHUTTER sw, and 3. Use programmer control nominally, or 4. Operate photometer experiment nominally, discontinue 16 mm camera data.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION		INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION		PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.2	Provide Power & Timing Functions						Ground Action: Phase D, F and H Crew Action: Phases D, F and H
2.2.2.1	Input Power Failure (OWS Bus 1)	M7002 OWS Bus 1 voltage (U): ≤ 23 VDC	M7004 OWS Bus 1 current (U): Proportionately low value	Mission: None Crew: Timeline effect	Loss of Photometer System and UXM	Loss of UXM for S149 and ECTV operation.	1. Open SAL outlet 1 and outlet 2 cb on CIRCUIT BREAKER panel No. 1 (613), disconnect power cable from Bus 1 outlet and connect to Bus 2 outlet.
2.2.2.2	Logic Power/Timing Failure (Pre Regulator, EMI filter, D.C. to DC converter, +5 Volt regulator, Clock, POWER sw-open, Power cables	All T027/S073 T/M (U): No data	Crew sensing (U): Loss of all electronic control	Mission: None Crew: Timeline effect	Loss of Photometer System and UXM	Loss of UXM for S149 and ECTV operation	1. Same as 2.1.1.1 Case II, Steps 1 through 4, and 2. Terminate experiment nominally Eject UXM if shaft or Trunnion was moved before failure occurred.
2.2.2.3	Fails to supply 115 Volts, 400 Hz power (Pre Regulator EMI Filter, 400 Hz power supply)	Crew Sensing (U): All 7 bar indicators blank (FOV, FW A&B, SHAFT, TRUNNION, CAP, and SHUTTER) in conjunction with ground reporting all T027/S073 data normal.	None	Mission: None Crew: Minor timeline effect	Loss of on board indicators	Loss of on board indicators for S149 operation and ECTV pointing.	1. a. Continue operating the experiment, use Auto Programmer only for Photometer operations, and b. Verify with ground that G7025T027 Shaft Position is 45° and G7016T027 Trunnion Position is 0° before retracting mast, and 2. Discontinue taking data and/or eject UXM nominally.
2.2.2.4	Fails to Supply 27 Volts, 400 Hz power (Pre Regulator EMI Filter, 400 Hz power supply)	G7025T027 Shaft Position, G7016T027 Trunnion Position, and K7171S073/ K7170T027 Polarizer Wheel sync, (U): No bit change in conjunction with Photometer being operated.	SHAFT ind and TRUNNION ind (U): Does not change position when commanded.	Mission: None Crew: Timeline effect.	Loss of motor power; Shaft, Trunnion, Polarizer Wheel, and S149 Motor cannot operate, Loss of UXM.	Loss of S149 and ECTV.	1. a. Discontinue use of UXM, and b. If SHAFT ind and TRUNNION ind in position 040 and 000 respectively, retract UXM nominally; if SHAFT ind and TRUNNION ind not in Position 040 and 000 respectively, eject UXM nominally.
2.2.2.5	Fails to supply camera power (camera filter)	K7308S073/K7309T027 Camera Exposure, inconclusive, Sample rate too low	None	Mission: None Crew: None	Loss of all 16 mm camera data	None	1. Continue all UXM operations, leave AUTOMATIC CAMERA sw in OFF.

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION		INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION		PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.2.6	Fails to provide PMT OP AMP Power (DC to DC converter, Regulator)			Mission: None Crew: Timeline effect	Loss of Photometer System.	None	1) Terminate Photometer operation nominally. Take 16 mm camera data only. Note: S149 and ECTV can still be operated.
	a. 28.5 V Failure	M7072S073/M7074T027 PMT Current (U): <.01 amp	None				
	b. ±13.2 Failure	M7072S073/M7074T027 PMT Current, G7025T027 Shaft Position, and G7016T027 Trunnion Position (U): No data	None				
2.2.2.7	Fails to Supply Solenoid Power (DC to DC Convertor)	K7277S073/K7265T027 PMT Shutter and K7276S073/7264T027 PMT Cap (U): Bit State 1 In conjunction with shutter and/or cap commanded open.	M7072S073/M7074T027 PMT Current (U): <.01 amps or PMT SHT lt and PMT CAP lt (U): ON	Mission: None Crew: Timeline effect	Loss of Photometer System	None	1) Terminate Photometer operation nominally. Take 16 mm camera data only. Note: S149 and ECTV can still be operated
2.2.2.8	Fails to supply stepper motor power (DC to DC Converter 29.5 Volt Regulator)	K7282S073/K7270T027 FW $A2^0$ K7283S073/K7271T027 FW $A2^1$ K7284S073/K7272T027 FW $A2^2$ K7285S073/K7273T027 FW $B2^0$ K7286S073/K7274T027 FW $B2^1$ K7287S073/K7275T027 FW $B2^2$ K7288S073/K7276T027 FOV 2^0 K7289S073/K7277T027 FOV 2^1 K7290S073/K7278T027 FOV 2^2 (Cont. on next page)	PMT CAP and SHT lt (U): ON and FW A & B ind, FOV ind, SHAFT ind, and TRUNNION ind (U): Does not change in reading in conjunection with respective control being operated.	Mission: None Crew: Timeline effect	Loss of Photometer System, and UXM	Loss of S149 and ECTV	1. a. Discontinue use of UXM, and b. If SHAFT ind and TRUNNION ind in position 040 and 000 respectively retract UXM nominally; if SHAFT ind and TRUNNION ind not in position 040 and 000 respectively, eject UXM nominally

MISSION PHASES:
A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

MALFUNCTION ANALYSIS CHART, T027

(1)

MALFUNCTION	INDICATION		EFFECT			ACTION
MALFUNCTION OR CONDITION	PRIMARY MEASUREMENTS	SUPPORT MEASUREMENTS	MISSION/CREW	SYSTEM/SUBSYSTEM	SYSTEM/ INTERACTION	CREW OR COMMAND
2.2.2.8 Fails to supply stepper motor power (continued)	K7279S073/K7267T027 Medium PMT Gain K7278S073/K7266T027 High PMT Gain K7277S073/K7265T027 PMT Shutter K7276S073/K7624T027 PMT Cap (U): bit state 0 and G7025T027 Shaft position G7016T027 Trunnion position (U): does not change position. Note: all of the above must occur to indicate this failure					

MISSION PHASES: A. All Phases
B. Boost to Orbit
C. Activation
D. 1st Visitation
E. 1st Storage
F. 2nd Visitation
G. 2nd Storage
H. 3rd Visitation

Mechanical malfunction items 2. 2. 3 through 2. 2. 4 eliminated from SEPEM at Laboratory's request.

(1)

3. GEGENSCHEIN/ZODIACAL LIGHT, S073

The S073 experiment employs the T027, Contamination Measurement, photometer system. T027 and S073 require data regarding contamination, starlight, gegenschein, and zodiacal light, therefore a single observing program is used to obtain the photometric and photographic data used by each experiment. As a result, the T027 (2.2) photometer system hardware is used for S073 and no additional malfunction analysis is required for S073.

SECTION X. CONCLUSIONS AND RECOMMENDATIONS

1. The T-027/S-073 experiment has the most sophisticated and complex experiment of the Skylab corollary experiments. It is a piece of precision machinery made up of many servo-mechanisms and is controlled by an automatic electronic programmer. Obviously, there are many possibilities for hardware failure; however, confidence has been gained from reviewing quality and acceptance test results. Rigorous testing of the photometer system has proven that the equipment performed well under severe operating conditions.

2. The analyses performed in Sections I and VIII resulted in making the investigator aware that some hardware failures can cause a significant impact on the continued operation of the experiment, and possibly jeopardize some secondary mission objectives. Failure of the extension/retraction subsystems imposes severe restrictions on the photometer experiment operations and could impact other experiments that use the SAL. If the photometer ejection system fails, then other Skylab experiments that use the SAL can not be scheduled.

   The orientation mechanism, extension/retraction, ejection and photomultiplier tube are considered critical T-027/S073 experiment subsystems. Failure of the orientation mechanism or the extension/retraction subsystems will cause the photometer system to be ejected. Failure of the ejection subsystem will cause the loss of the SAL. Failure of the photomultiplier tube subsystem will cause the experiment to be terminated.

3. The crew procedures specified in Table III have been coordinated with Mr. W. Teague of MSC, and are considered up-to-date. Additional contingency plans will be added to Table VIII, as time permits their development.

REFERENCES

1. Mission Requirements for Skylab Missions SL-1/SL-2, SL-3 and SL-4. Vol. I-III, 1-MRD-001E, Marshall Space Flight Center, Huntsville, Alabama, and Manned Spacecraft Center, Houston, Texas, Latest Rev.: Vol. I, December 1972, and Vol. II and III, June 14, 1972.

2. Radiation and the Atmosphere (Supplement). Stanford Research Institute Journal, Vol. VII, Number 2. Menlo Parks, California, 1963.

3. Gary, G. A. and Craven, P. D.: A Study of Zodiacal Light Models (Introductory Material, in preparation). Space Sciences Laboratory, Marshall Space Flight Center, Huntsville, Alabama.

4. Weinberg, J. L.: White Light Versus Narrow-Band Observations of the Polarization of the Zodiacal Light. Nature, Vol. 198, June 1, 1963.

5. Vsekhsvyatskiy, S. K.: The Nature and Origin of Comets and Meteors. NASA, TT F-608, Clearinghouse of Federal Scientific and Technical Information, Springfield, Virginia, 1970.

6. Weinberg, J. L. ed: The Zodiacal Light and the Interplanetary Medium. NASA, SP-150, U. S. Government Printing Office, Washington, D. C., 1967.

7. Weinberg, J. L.: Success Criteria for the Photometer, SL-2, Memorandum, unnumbered, Dudley Observatory, Albany, New York, April 20, 1972.

8. Skylab Console Handbooks (Preliminary). S073, Lunar Excursion Module/Shuttle Systems Branch, Manned Spacecraft Center, Houston, Texas, 1972.

9. Skylab Flight Plan SLM-1 (SL-1/2), and SL-3 and SL-4 (unnumbered). Manned Spacecraft Center, Houston, Texas, November 15, 1972 for SLM-1 and May 1, 1972 for SL-3 and SL-4.

10. Experiments Requirements Document for Contamination Measurement (Experiment T-027) and Gegenschein/Zodiacal Light (Experiment S-073) Photometer System. Document No. I-MRD-001F, Marshall Space Flight Center, Huntsville, Alabama, February 1, 1973.

11. Minutes of the Third Scientific Airlock Experiments Mission Operations Requirements Working Group Meeting. KM-62033, Manned Spacecraft Center, Houston, Texas, November 9, 1972.

12. Skylab Program Operational Data Book. Vol. I: Experiments Performance Data, Experiment T-027/S-073, MSC-01549, Manned Spacecraft Center, Houston, Texas, September 1970.

13. Skylab Program Directive No. 43B. M-D ML3200.125, NASA Office of Manned Space Flight, Washington, D. C. March 27, 1972.

14. Flight Scheduling Precedence List. MLO, NASA, ML/Director, Skylab Program, Washington, D. C., October 25, 1972.

15. Skylab Experiments Operations Handbook. Vol. I: Experiment Descriptions, MSC-00924, Manned Spacecraft Center, Houston, Texas, September 1970.

16. Operating, Maintenance and Handling Procedures for T-027 Photometer System Flight Hardware. MCR-72-16, (Rev. 2), Martin Marietta Corporation, Denver, Colorado, October 1972.

17. Skylab Program Payload Integration Requirements: Experiment Operational Data. ED-2002-1482, Martin Marietta Corporation, Denver, Colorado, May 31, 1972.

18. Photometer Assembly, Dwg. No. 899T027310 (Rev. H), Martin Marietta Corporation, Denver, Colorado, November 2, 1971.

19. Head Assembly - Photometer. Dwg. No. 899T0270360, (Rev. R), Martin Marietta Corporation, Denver, Colorado, February 4, 1972.

20. Skylab Program Optical Scattering and Contamination Experiment T027/S073 Drawing List. MCR-70-37 (latest revision), Martin Marietta Corporation, Denver, Colorado, October 1, 1972.

21. Skylab Experiments Design Certification Review T027/S073 Photometer. Unnumbered, Marshall Space Flight Center, Huntsville, Alabama, July 2, 1972.

22. Mission Operations Design Support, Vol. III. OWS Experiments Malfunction Analyses - T027 Photometer. ED-2002-1244 (Rev. B), Marshall Space Flight Center, Huntsville, Alabama, July 28, 1972.

23. Canister Shell Assembly - Photometer. Dwg. No. 899T027320 (Rev. J), Martin Marietta Corporation, Denver, Colorado, January 12, 1972.

24. Photometer Failure Mode, Effects, and Criticality Analysis. MCR-70-131, Martin Marietta Corporation, Denver, Colorado, May 7, 1970.

25. Extension Tube Assembly - Photometer. Dwg. No. 899T0270301 (Rev. E), Martin Marietta Corporation, Denver, Colorado, January 12, 1972.

26. Eject Tube - Photometer. Dwg. No. 899T0270304 (Rev. F), Martin Marietta Corporation, Denver, Colorado, January 10, 1972.

27. Cluster Requirements Specificiation, Performance and Design Integration Requirements for the Cluster System/Apollo Applications Program General Specifications for RS003M00003. Marshall Space Flight Center, Huntsville, Alabama, August 8, 1969.

28. Scientific Airlock Experiments Thermal Integration Analysis Summary. ED-2002-1464, Martin Marietta Corporation, Denver, Colorado, March 30, 1972.

29. Flight Qualification and Delta Flight Qualification Test Report, Optical Scattering and Contamination Experiment (T027/S073). MCR-72-296, Martin Marietta Corporation, Denver, Colorado, December 1, 1972.

30. Materials and Parts List for Photometer System, Optical Scattering and Contamination Experiment (T-027). MCR-70-127, Martin Marietta Corporation, Denver, Colorado, May 6, 1970.

31. Photometer Tripod. Dwg. No. 1B89504, McDonnell Douglas Astronautics Company-West, Huntington Beach, California, undated.

32. T027/S073 Photometer Tripod Installation 1B89504. Memorandum S&E-ASTN-DIR (72-385), Marshall Space Flight Center, Huntsville, Alabama, October 11, 1972.

33. Cover Plate. Dwg. No. 899T0270311 (Rev. D), Martin Marietta Corporation, Denver, Colorado, December 22, 1971.

34. Lock and Latch Details. Dwg. No. 899T0270380 (Rev. K), Martin Marietta Corporation, Denver, Colorado, December 13, 1971.

35. Lock Latch Panel. Dwg. No. 899T0270392 (Rev. G), Martin Marietta Corporation, Denver, Colorado, December 20, 1971.

36. Common Electronic Panel Assembly - Photometer. Dwg. No. 899T0270270 (Rev. C), Martin Marietta Corporation, Denver, Colorado, March 22, 1972.

37. Skylab Experiments Systems Handbook. MSC-07623 (Rev. A), Manned Spacecraft Center, Houston, Texas, December 6, 1972.

38. Schematic Diagram - Power Supply. Dwg. No. 899T0270501 (Rev. A), Martin Marietta Corporation, Denver, Colorado, November 5, 1971.

39. Test Specification, Power Supply. Dwg. No. 899T0270522 (Rev. D), Martin Marietta Corporation, Denver, Colorado, August 28, 1972.

40. Test Specification Common Control Panel. Dwg. No. 899T0270261 (Rev. A), Martin Marietta Corporation, Denver, Colorado, August 21, 1972.

41. Schematic Diagram Manual Control Assembly, Photometer. Dwg. No. 899T0270227 (Rev. D), Martin Marietta Corporation, Denver, Colorado, November 9, 1971.

42. Test Specification Manual Control Assembly. Dwg. No. 899T0270260 (Rev. C), Martin Marietta Corporation, Denver, Colorado, September 6, 1972.

43. Automatic Programmer, S073. Dwg. No. 608-7809-001 through 005, Collins Radio Company, Cedar Rapids, Iowa, June 24, 1970.

44. Schematic Diagram - Automatic Programmer Adapter. Dwg. No. 899T027269 (Rev. A), Martin Marietta Corporation, Denver, Colorado, February 11, 1972.

45. Specification for S073 Automatic Programmer Equipment, Dwg. No. 568-4202-001 (Rev. B), Collins Radio Company, Cedar Rapids, Iowa, August 27, 1970.

46. Flight Unit S073 Automatic Programmer Data Package. Memorandum JGH-0672-21, Collins Radio Company, Cedar Rapids, Iowa, June 22, 1972.

47. UXM Structure. Dwg. No. 899T0270342 (Rev. C), Martin Marietta Corporation, Denver, Colorado, October 7, 1970.

48. Mast Assembly - Photometer. Dwg. No. 899T0270340 (Rev. H), Martin Marietta Corporation, Denver, Colorado, January 7, 1971.

49. Mast Support Tube Assy. - Photometer. Dwg. No. 899T0270344 (Rev. M), Martin Marietta Corporation, Denver, Colorado, June 2, 1972.

50. Boom and Gimbal Assembly. Dwg. No. 899T0270280 (Rev. M), Martin Marietta Corporation, Denver, Colorado, August 16, 1972.

51. Test Specification Boom and Gimbal Assy. Dwg. No. 899T0270263 (Rev. B), Martin Marietta Corporation, Denver, Colorado, August 16, 1972.

52. Elevation Assembly. Dwg. No. 899T0270170 (Rev. H), Martin Marietta Corporation, Denver, Colorado, June 21, 1972.

53. Azimuth and Elevation Assembly - Photometer. Dwg. No. 899T0270350 (Rev. F), Martin Marietta Corporation, Denver, Colorado, January 31, 1972.

54. Azimuth Yoke Assembly - Photometer. Dwg. No. 899T0270352 (Rev. G), Martin Marietta Corporation, Denver, Colorado, January 24, 1972.

55. Azimuth Hub Assy. - Photometer. Dwg. No. 899T0270353 (Rev. E), Martin Marietta Corporation, Denver, Colorado, October 27, 1971.

56. Azimuth Assembly. Dwg. No. 899T0270169 (Rev. G), Martin Marietta Corporation, Denver, Colorado, June 21, 1972.

57. Procurement Specification Detector Package for Skylab Flight Experiment S073. PRO-SPEC-ZL-DP-101, Dudley Observatory, Albany, New York, April 1970.

58. Test Specification Photometer Head Assembly, Dwg. No. 899T0270264 (Rev. A), Martin Marietta Corporation, Denver, Colorado, August 15, 1972.

59. Test Specification Camera FOV Board. Dwg. No. 899T0270253 (Rev. A), Martin Marietta Corporation, Denver, Colorado, February 1, 1972.

60. Sensor-Cap Shutter Temperature. Dwg. No. 899T0270230 (Rev. K), Martin Marietta Corporation, Denver, Colorado, May 26, 1972.

61. Cap Shutter Assembly. Dwg. No. 899T0270369, (Rev. G), Martin Marietta Corporation, Denver, Colorado, February 8, 1972.

62. Skylab Console Handbooks (Preliminary). S073, Lunar Excursion Martin Marietta Corporation, Denver, Colorado, September 30, 1971.

63. Filter Wheel Assembly. Dwg. No. 899T0270371, (Rev. G), Martin Marietta Corporation, Denver, Colorado, March 29, 1972.

64. Sunshield Details - Photometer. Dwg. No. 899T0270376 (Rev. F), Martin Marietta Corporation, Denver, Colorado, December 15, 1971.

65. Sunshield Details - Camera. Dwg. No. 899T0270375 (Rev. D), Martin Marietta Corporation, Denver, Colorado, December 15, 1970.

66. Sunshield Assy. - Camera. Dwg. No. 899T0270361 (Rev. E), Martin Marietta Corporation, Denver, Colorado, July 24, 1972.

67. Sunshield Assy. - Photometer. Dwg. No. 899T0270362 (Rev. F), Martin Marietta Corporation, Denver, Colorado, July 24, 1972.

68. Interface Parameter of the 16MM Data Acquisition Camera Report CF74-A-716, Manned Spacecraft Center, Houston, Texas, October 1, 1971.

69. Photometer Complete. Dwg. No. 899T0270300 (Rev. C), Martin Marietta Corporation, Denver, Colorado, December 9, 1971.

70. Flight Stowage and Ground Storage Container Assemblies. Dwg. No. 899T0270303 (Rev. L), Martin Marietta Corporation, Denver, Colorado, March 1, 1972.

71. Specification Change Notice No. 56, Mission Requirements, Second Skylab Mission (SL-3). I-MRD-001, Vol. II (Rev. F), Johnson Spacecraft Center, Houston, Texas, March 1, 1973.

72. T027 Photometer Integrity. S&E-ASTN-ASV (72-47), Marshall Space Flight Center, Huntsville, Alabama, October 3, 1972.

73. T-027/S-073 Drawing List. MCR-70-37, Rev. 28, Martin Marietta Corporation, Cenver, Colorado, December 15, 1972.